



Macintosh[®] Computers

Service Guide

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Phone: _____

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The **Apple Service Guide for Macintosh Computers** is a product of the Service Technical Publications Department. The ASG development team includes the following persons:



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Apple Service Guide

Macintosh Computers—Introduction



Introduction

The *Apple Service Guide for Macintosh Computers* is the first release in a series of booklets being developed to help Apple-certified technicians troubleshoot and repair Apple products at their customers' sites. Future releases in the *Apple Service Guide* series will cover, in the order of their expected release, LaserWriter printers, networking and communications, imaging devices, and Macintosh peripherals.

The *Apple Service Guide for Macintosh Computers* does not replace the *Apple Service Technical Procedures*. The *Apple Service Guide* takes pieces of information from the *Technical Procedures* and other Service publications, and presents this information in a booklet format that is easy to use and easy to carry. The guide includes *only* information that experienced technicians have told us will help them service Macintosh computers more quickly and reliably at the customer's site.

Key features, contents, and suggestions for using the *Apple Service Guide for Macintosh Computers* are described below.

Key Features

- **Portability**—At 5-1/2 inches by 8 inches, the guide is easy to handle and carry. Guide length has been kept under 150 pages to ensure that it can be easily molded around tools or slipped into the side-pocket of a briefcase.
- **Ease of use**—Front to back, the guide has been designed to ensure its usability. The plastic spiral-binding is tough and enables you to lay the book open on any available surface. The paper is durable, and its matte finish prevents glare from overhead lighting. And the booklet uses tabs, subject/product icons (in the upper-outside corner of each page), and color-highlighted headings (at the top of the page) to help you locate information more quickly.
- **Presentation of information**—Information has been condensed to the extent possible while type size has been kept easily readable. Extensive use has been made of charts, tables, and graphics to present information clearly and concisely.
- **No updating required**—This guide includes predominantly stable information, and will be updated only as necessitated by product changes or new product introductions. When an updated version of the guide is available, the new version will completely replace the old.
- **Professional appearance**—The guide is a high-quality Apple publication that you'll be proud to refer to. Its cover employs a new Service design and has a protective coating to resist stains. Color has been used throughout the book to emphasize important information. And the high-resolution printing process ensures both the professional appearance and the readability of all material in the guide.



Apple Service Guide

Macintosh Computers—Introduction

Using the Guide/Guide Contents

The *Macintosh Computers* guide has an introductory section (devoted to safety practices and procedures) and seven tab sections:

- Tab 1: Macintosh 128K, 512K, 512K enhanced, and Plus
- Tab 2: Macintosh SE and SE/30
- Tab 3: Macintosh Portable
- Tab 4: Macintosh II, IIx, and IIcx
- Tab 5: Macintosh IIfx and IIfx
- Tab 6: General Information
- Tab 7: Ports and Cables

The five Macintosh computer sections (tabs 1 through 5) contain information specific to those particular models of the Macintosh computer. The types of information included in these tab sections, however, are much the same:

- Exploded view and logic board drawings of the Macintosh system
- System specifications
- Parts lists with part numbers—replacement parts are indented beneath the main modules*
- System adjustment and upgrade procedures
- Symptom/cure charts

The General Information section contains information that is pertinent to all Macintosh computers. In this section you can find the following:

- Internal disk drive information
- SIMM identification and system-software compatibility tables
- Guide to system failure and error codes
- Generic troubleshooting guide and flowchart with MacTest™ hookups
- Special tools index

The Ports and Cables section includes a table of peripheral cables, Macintosh external connectors, tables of peripheral cable pin-outs, and pinfaces.

****IMPORTANT: When ordering a replacement module or spare part, be sure to check the part number given in the guide against the current price pages in the Apple Service Programs manual. Remember that the Apple Service Guide is not updated on a regular basis.***

To Apple's On-Site Technicians:

We hope you always carry and use the *Apple Service Guides* when responding to on-site service calls. Help us ensure that these guides meet your needs. Send your recommendations for future releases of the *Apple Service Guide* to us at the following AppleLink® address:

AppleLink: ASG

Safety

Warnings



WARNING: The compact Macintosh computers contain high voltage and a high-vacuum picture tube. To prevent serious personal injury and property damage, make sure you read and understand the safety precautions on the following pages.



WARNING: Voltage and video adjustments are performed with the power on. Review the following CRT safety and live adjustment rules before performing these adjustments.



WARNING: Failure to follow the rules for safe CRT discharge could result in serious injury or property damage. For compact Macintoshes, the CRT must be discharged to the ground lug to prevent damage to the logic board.



WARNING: Make sure that you are *not* grounded when:

- You are working on plugged-in equipment
- You are discharging a cathode-ray tube (CRT)
- You are working on an unplugged CRT that has not yet been discharged
- You are performing live adjustments



WARNING: Electrostatic discharge (ESD) can cause severe damage to sensitive microcircuits. Macintosh circuit boards contain CMOS components, among the most sensitive chips in use today. CMOS chips, ROMs, and SIMMs are very susceptible to ESD and skin acid damage. To prevent damage to these components, handle them only by the edges.



WARNING: Pulling a disk forcefully from a drive may damage the mechanism. If a disk does not fully eject, refer to "Disk Ejection Problems" in the General Information section.



WARNING: Lithium batteries have some potential for explosion if improperly handled. "Dead" lithium batteries are considered hazardous waste and must be returned to Apple in their original packaging for disposal following EPA guidelines.



Safety

CRT Safety

Ten Rules to CRT Safety

1. **Do not work on a monitor alone.** In case of an accident, having someone nearby—and having someone trained in CPR—could save your life.
2. **Remove all jewelry before performing repairs on a CRT.** Removing these conductors reduces the possibility of electric shock.
3. **Never use a grounding wriststrap or heelstrap or work on a grounded workbench mat when discharging a monitor or when performing live adjustments.** Grounding straps and mats are used to protect sensitive components from ESD damage and should be used only when working on “dead” (uncharged) equipment.
4. **Wear safety goggles when working with a CRT.** The CRT contains a high vacuum. If cracked or broken, it can implode (collapse into itself). To protect your eyes, always wear safety goggles.
5. **Before working inside a monitor, turn off the power and disconnect the AC power cord.** Certain parts of a monitor chassis are hot (electrified) when the monitor is under power. Never work on a monitor under power except when when making live adjustments.
6. **Keep one hand in your pocket or behind your back when working on a live monitor.** This reduces the risk of current passing through your body, should you accidentally contact high voltage.
7. **Always discharge the anode before touching anything inside the monitor.** High voltage (up to 12,000 volts DC) can be present on the anode (see Figure) and other components—even when power is off.
8. **Never touch the anode connector or the anode aperture.** When a CRT is replaced, the anode connector is removed, exposing the anode. The anode can retain a charge of several thousand volts even when power is off and can regain some charge even after being discharged.
9. **Do not pick up or handle a CRT by its neck (see Figure).** To prevent an implosion, take every precaution against breaking the tube. Be especially careful with the neck, where the tube is thinnest.
10. **In addition, never touch the following components (see Figure) when adjusting a live Macintosh CRT:**
 - The back of the power switch
 - The yoke wires
 - The anode connector
 - The anode wire
 - The flyback transformer

Safety

CRT Safety

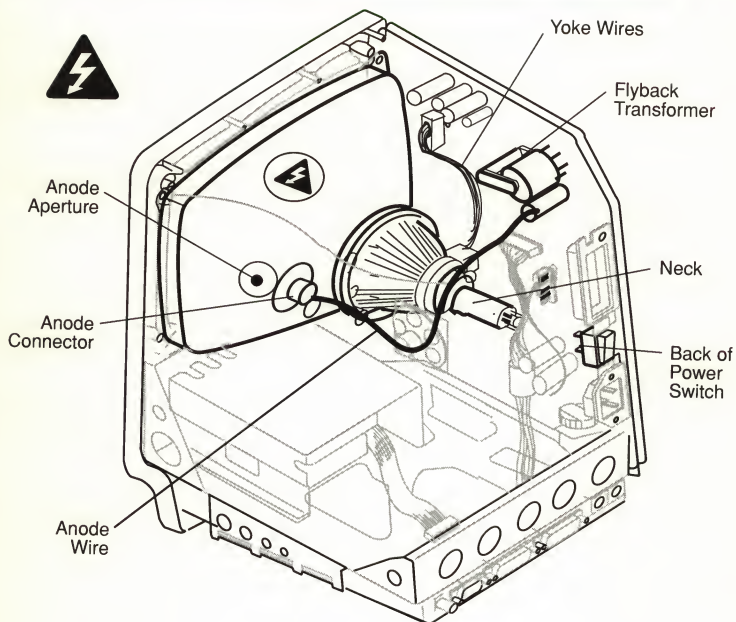


Figure: CRT High-Voltage Areas

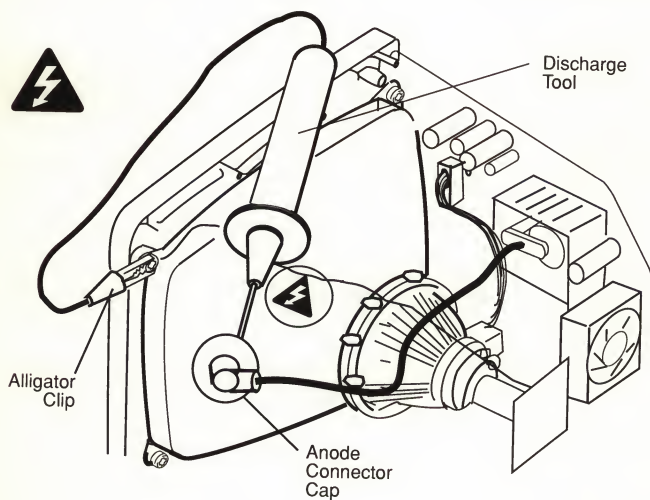


Figure: Discharging the CRT



Safety

Discharging & Devacuuuming the CRT

Use the following procedure to discharge high voltage (12,000 volts) from the picture tube of a compact Macintosh. This procedure and the CRT discharge tool (see "Special Tools Index" in the General Information section) can be used to discharge any Macintosh monitor.



WARNING: Discharge the anode to the metal ground lug (see Figure on the previous page). Failure to do so will damage the logic board.

Discharge Procedure

1. Remove your grounding wriststrap and jewelry, and put on safety goggles.
2. Attach the alligator clip on the CRT discharge tool to the metal part of the ground lug (see Figure on the previous page).
3. Put one hand in your pocket or behind your back. With your other hand, insert the tip of the CRT discharge tool under the anode cap (see Figure) until it touches the anode ring.
4. Remove the CRT discharge tool. To be sure the CRT is discharged, repeat the discharge procedure (you may want to repeat the procedure using a flat-blade screwdriver with an insulated handle).

Note: The anode can build up voltage over a period of time. To drain off any residual charges, establish an ongoing ground. Fasten one end of an alligator lead to the ground lug and the other end to the anode aperture.

Disposing of the Cathode-Ray Tube (CRT)

To prevent serious injury, follow the procedure described in this section whenever discarding a CRT.



WARNING: To properly dispose of a defective CRT you must first devacuum the cathode-ray tube. Discarded CRTs that have not been devacuumed may become cracked and implode, injuring anyone who happens to be near.

Materials Required

Thick cardboard box large enough to conceal the CRT
Large, sharp diagonal cutters
Large pliers and duct tape
Safety goggles and gardening gloves
12" x 12" piece of cloth or heavy paper

Devacuuuming Procedure

1. Put on safety goggles.
2. In the side of the box, about six inches from the bottom, cut a hole just large enough to insert the tip of the CRT neck.
3. Place the CRT inside the box with the tip of the neck protruding through the hole, and tape the box flaps down with the duct tape (see Figure).

Safety

ESD Prevention

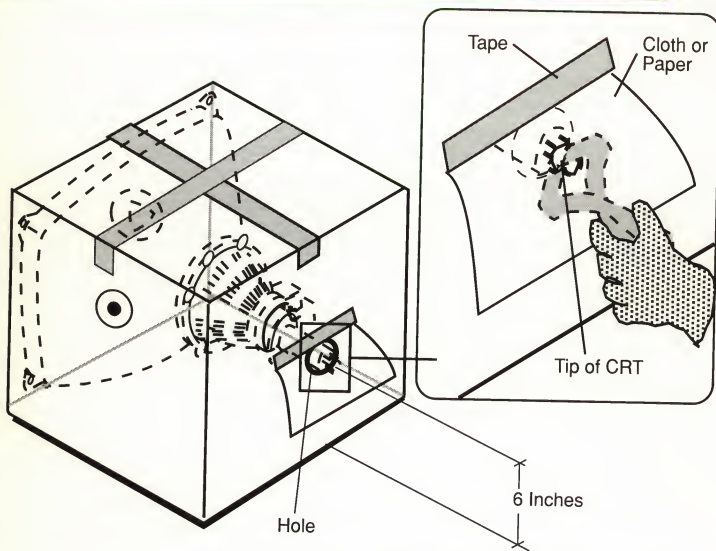


Figure: Devacuuming the CRT



WARNING: Only the very tip of the CRT neck should be protruding through the hole in the box, and the box must not have any other opening.

4. Put on the gloves and, using the diagonal cutters, carefully clip off the connector pins on the end of the CRT neck.
5. Tape the piece of cloth or paper onto the box so that it forms a veil over the opening, but allows access to the tip of the CRT. The veil's purpose is to catch bits of glass that may fly during the next step.
6. Make sure no one is standing nearby. Then stand to one side, reach under the veil, and with the large pliers grasp the exposed tip of the CRT. **Look away while you snip off the tip of the CRT.**

Note: You will probably hear a rush of air entering the CRT when the CRT vacuum breaks—but even if you don't, the procedure is complete if the tip of the CRT is clearly broken off.

ESD Prevention

Electrostatic discharge (ESD) can irreparably damage the sensitive CMOS chips and printed circuitry of modern electronic components. Plastic utensils, styro-foam cups, polyester clothing, even the ungrounded touch of your hand carry sufficient electrostatic charges to damage electronic components. Follow the ESD prevention rules and procedure on the next page to prevent ESD damage.



Safety

ESD Prevention

ESD Prevention Rules

1. **Before working on any device containing a printed circuit, ground yourself and your equipment.** Use a grounded conductive workbench mat and a grounding wriststrap, and ground your equipment to the mat. However:



WARNING: Make sure that you are *not* grounded when:

- You work on plugged-in equipment
- You discharge a cathode-ray tube (CRT)
- You work on an unplugged CRT that has not yet been discharged

2. **Do not touch anybody who is working on integrated circuits.** You could “zap” the equipment through the technician—even if the technician is grounded.
3. **Use static-shielding bags for boards and chips during storage, transportation, and handling.** Leave all Apple service exchange components in their ESD-safe packaging until you need them.
4. **Handle all ICs by the body, not the leads.** Also, do not touch the edge connectors or exposed circuitry on boards or cards.
5. **Do not wear polyester clothing or bring plastic, vinyl, or styrofoam into the work environment.** The electrostatic field around these nonconductors cannot be removed.
6. **Never place components on any metal surface.** Use antistatic, conductive, or foam rubber mats.
7. **If possible, keep the humidity in the service area between 70% and 90%, and use an ion generator.** Charge levels are reduced (but not eliminated) in high-humidity environments and in areas with ion generators.
8. If an ESD pad/workstation (see below) is not available, touch bare metal on the power supply to discharge electrostatic charges.

Setting Up an ESD-Safe Workstation

Materials Required

Conductive workbench mat with ground cord
Wriststrap with built in 1-megohm resistor and ground cord
Equipment ground cord with alligator clips
Ground/polarity tester

Setup and Procedure

1. **Remove all ESD hazards from the area.** Nonconductive materials (see rule #5 above) cannot be grounded and retain charges for hours and even days.
2. **Use a ground/polarity tester to verify proper grounding of the power outlet.** If the outlet is wired incorrectly, most testers show a light pattern that matches a code given on the tester. If the tester does not verify proper grounding, move to another outlet that is safe.
3. **Connect the ground cord of the workbench mat to ground.**
4. **Use a wriststrap ground cord. Fasten it to the workbench mat and to the wriststrap.** The wriststrap should touch your skin.
5. **Finally, ground the equipment you are working on.** Use alligator clips and a grounding cord to attach any metal part of the device you are working on to the grounded workbench mat.

Macintosh and Macintosh Plus

Table of Contents



128K, 512K,
& Plus

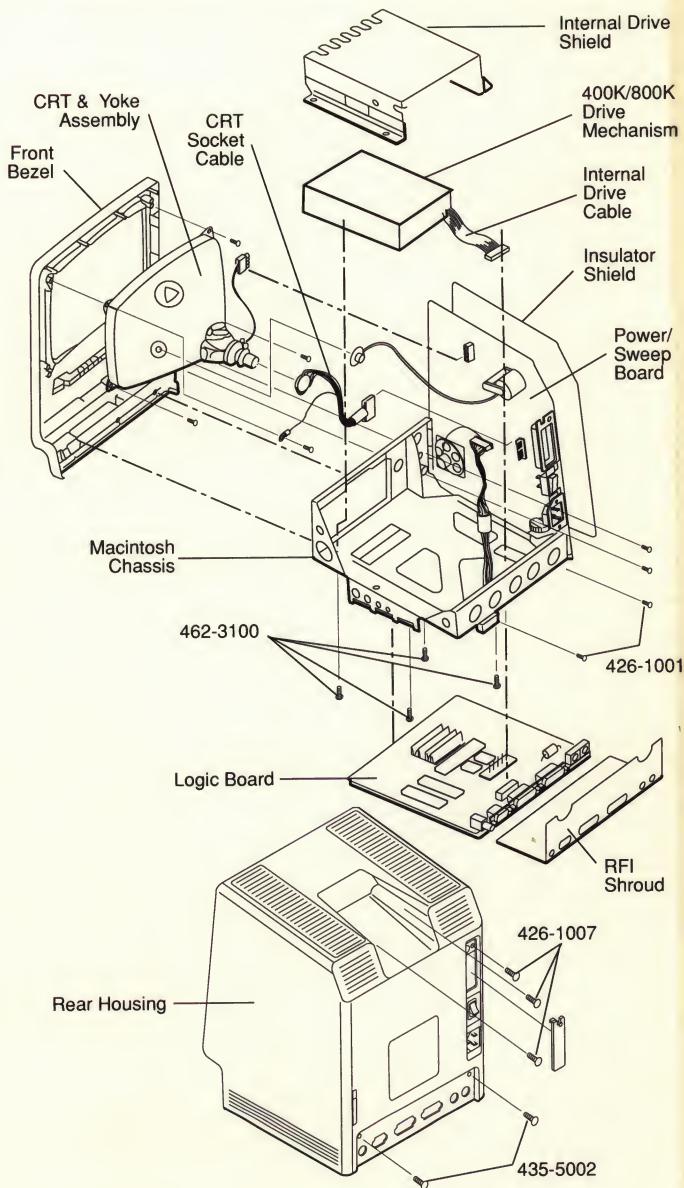
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Macintosh and Macintosh Plus

Exploded View



Macintosh and Macintosh Plus

Logic Board Identification

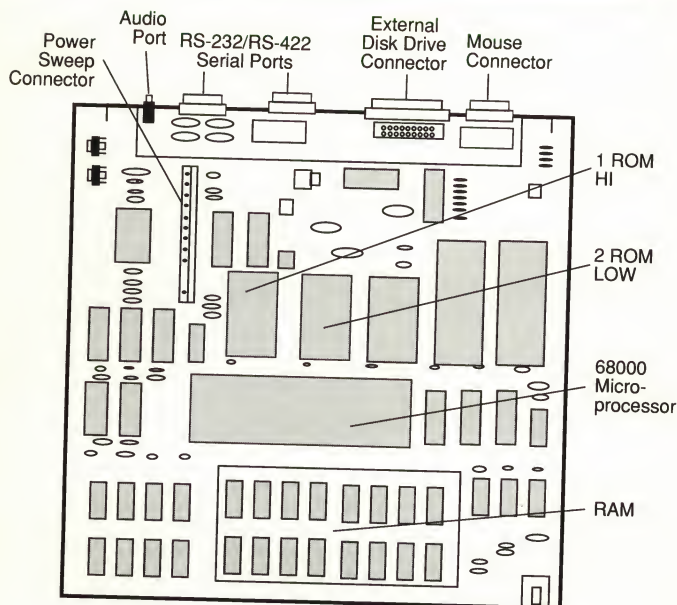
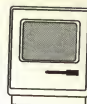


Figure: Macintosh 128K/512K Logic Board

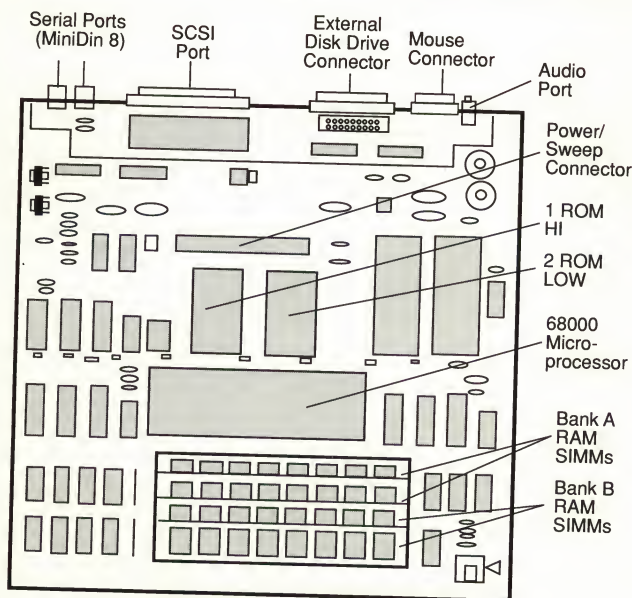


Figure: Macintosh Plus 1 MB Logic Board



Macintosh and Macintosh Plus Specifications

Macintosh/Macintosh Plus Specifications	
Microprocessor	MC68000; 32-bit internal data bus 7.83 MHz clock speed
Memory	128K, 512K Plus: 1 MB, expandable to 4 MB 128K ROM standard
Video Display	9-inch (diagonal) screen; 512 by 342-pixel bit-mapped display
Interfaces	Two RS-232/RS-422 serial ports (DB-9 on the Macintosh 128K/512K; Mini DIN-8 on the Macintosh Plus) One SCSI parallel port (Macintosh Plus only) One DB-19 external disk drive port One sound port
Internal Storage	Built-in 3.5-inch 400K drive for 128K and 512K Built-in 3.5-inch 800K drive for 512K and Plus (uses 3.5-inch hard-case floppy disks either double-sided with 800K capacity, or single- sided with 400K capacity)
Sound	Four-voice sound with 8-bit digital/analog conversion using 22 KHz sampling rate
Clock/Calendar	CMOS custom chip with 4.5-volt user- replaceable battery backup (includes 256 bytes of memory which remembers system parameters even with the machine turned off)
Electrical	Line voltage: 105 to 125 volts AC Frequency: 50 to 60 Hz Maximum power: 60 watts

Macintosh and Macintosh Plus

Parts List



Macintosh only

400K Mechanism, Apple 3.5 Drive	661-76156
Shield for Internal Drive	805-0765
128K Main Logic Board	661-96152
512K Main Logic Board	661-96236
IC, ROM Low (128K/512K logic boards, not upgraded)	342-0221
IC, ROM High (Upgraded 512K boards—supports 800K drives)	342-0220
RFI Shroud	805-0577
Front Bezel	810-0373
Mylar Washer	725-0018
Keyboard Parts:	
Keyboard Bottom Case	815-0754
Keyboard Top Case	815-0728
Keycap Set	658-7039
Rear Housing with Label	630-5139
Agency Approval Label	825-4018
Agency Approval Label, 512K Enhanced	825-1014
Battery, Alkaline, 4.5 V	742-0003
Logo Label (Bezel)	825-0547
Logo Label (Housing)	825-0613
Macintosh Battery Door, Beige	815-0938
Macintosh Foot	865-0051
Macintosh Label	825-0742
Macintosh Signature 512K Label	825-1065
Reset/Interrupt Switch, Beige	815-0737
Reset/Interrupt Switch, Smoke	815-0763
Screw, Tap, 8-32 x .625 Fill, Torx, Black Zinc Oxide	435-5002
Screw, Tap, M 4.22 x 1.41 x 16, Torx, Zinc	426-1007

Macintosh Plus only

Floppy Metal Housing (for transporting)	805-5050
Packing Disk, 2-sided (for transporting)	003-0003
Screw, M 3 x 6, with two washers	462-3401
Front Bezel	810-0379
Ground Clip	805-0910
Logo Plate Label	825-1256
Keyboard, Platinum (with cable)	661-0416
Keyboard, Platinum, French Canadian	C661-0416
Keyboard, Platinum, German	D661-0416
Keyboard, Platinum, Spanish	E661-0416
Keyboard, Platinum, French	F661-0416
Keyboard, Platinum, Italian	T661-0416
Keyboard Parts:	
Bottom Cover, Beige	815-0937
Bottom Cover, Platinum	815-0984
Keycap Set, Beige	658-5186
Keycap Set, Smoke	658-5190
Mitsumi Keyswitch	705-0104
Mitsumi Locking Keyswitch	705-0044
Top Cover, Beige	815-0936
Top Cover, Platinum	815-0983



Macintosh and Macintosh Plus

Parts List

Logic Board (w/o RAM; replaces 661-0321)	661-0525
Macintosh Plus RFI Shroud	805-5047
Resistor, 150 Ohms, 1/4 W, $\pm 5\%$	101-4151
SIMM, 256K, 120 ns	661-0402
SIMM, 256K, DIP, 120 ns	661-0494
SIMM, 1 MB, 120 ns	661-0403
Rear Housing, Beige	630-5211
Agency Approval Label, Beige	825-1254
Battery Door, Beige	815-0938
Rear Housing, Platinum	630-5235
Agency Approval Label, Platinum	825-1345
Battery Door, Platinum	815-0971

Macintosh & Macintosh Plus

800K Mechanism, Apple 3.5 Drive (512K Enhanced)	661-0345
3-1/2" Drive Cable Internal (red stripe)	590-0167
3-1/2" Drive Cable Internal (yellow stripe) (512K Enhanced)	590-0437
Shield for Internal 800K Drive (512K Enhanced)	805-0217
CRT and Yoke Assembly	076-0103
Keyboard, Beige (replacing 661-96154)	661-0322
Alps Alpha Lock Keyswitch	705-0077
Alps Long-Stem Keyswitch	705-0070
Keyboard/Keypad Cable, Beige	590-0144
Keyboard/Keypad Cable, Smoke	590-0170
Screw, Tap 2.20 x 6.25 (Keyboard Case)	430-1025
Macintosh Chassis	805-0766
Screw, Tap, 6-32 x .375, Chassis Grounding	490-0002
Screw, Tap, M 4.22 x 1.41 x 13 (CRT & Chassis)	426-1001
Screw, M 3 x .5 x 6	462-3100
Macintosh Mouse	661-96155
Apple Mouse, Platinum	661-0400
Mouseball Retainer	815-0409
Rubber-Coated Mouseball	699-8001
Numeric Keypad Assembly	658-4045
Macintosh Foot	865-0051
Screw, Tap, 2.2 x 6.25	430-1025
Power Cable, Beige	590-0138
Power Cable, Smoke	590-0131
Power Supply, Beige	661-0461
Power Supply, Platinum	661-0462
Power/Sweep Board, 220 V	861-76214
Brightness Knob, Smoke	865-0029
Cable, CRT Socket	590-0160
Cable, Power Supply to Logic	590-0184
Fuse, Power Supply, Int'l, 1.6 A 250 V	740-0060
Fuse, Power Supply, U.S., 2.5 A 250 V	740-0300
Insulator Shield (Back of Power Supply)	725-0011
Lower Ground Clip	805-0576
Screw, 2.9 x 10 mm	470-2101
Service Packaging, 800K/1.4 MB Drives	602-0210

Macintosh and Macintosh Plus

Power/Sweep Voltage Adjustment



You must verify correct voltages whenever the logic board or power/sweep board is replaced. If the voltages are outside specified tolerances, perform the voltage and video adjustments.

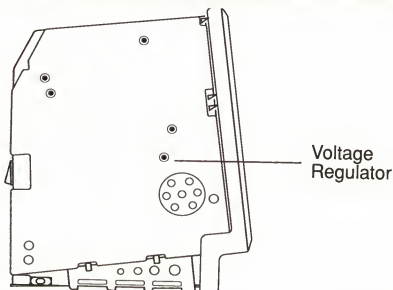


Figure: Voltage Adjustment Control



WARNING: Voltage adjustments are performed with the power on. Review the CRT safety and live adjustment rules before performing this procedure.



WARNING: When using the voltmeter, make sure the banana plug test probes do not short to one another, which will damage the Macintosh. Pull the insulating rubber hoods down over the test probes.

Voltage Adjustment Procedure

1. Switch off power, disconnect the power cord, and disconnect any peripheral devices.
2. Connect the **voltage test cable** to the **external disk drive port**.
3. Use the voltmeter and **orange** test cable as follows:
 - a. Connect the **black** voltmeter lead between the ground terminal of the voltmeter and the computer chassis.
 - b. Connect the **orange** test cable lead (12-volt lead) to the voltage input terminal on the voltmeter.
 - c. Connect the power cord and switch on the computer. The voltage reading must be from **11.90 to 12.75 volts**.
 - d. If not within tolerance, use the plastic alignment tool to adjust the voltage regulator on the power/sweep board (**see Figure**).
4. Switch off computer power and disconnect the orange lead.
5. Connect the **red** test cable lead (5-volt lead) to the voltage input terminal and switch on computer. If the voltage reading is not from **4.85 to 5.15 volts**, adjust the voltage regulator (**see Figure**).
6. Repeat steps to verify correct voltages. Replace the power/sweep board if correct voltages cannot be attained.



Macintosh and Macintosh Plus

CRT Yoke Adjustments

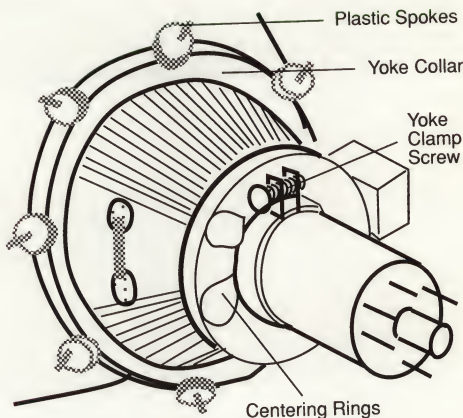


Figure: CRT Adjustment Controls



WARNING: Video adjustments are performed with the power on. Review the CRT safety rules before performing these procedures.

Tilt Adjustment Procedure

1. Remove the cover and discharge the CRT. Turn the computer so that the back is facing you, and place a mirror in front of the CRT screen.
2. Loosen the **yoke clamp screw** two or three turns.
3. Connect the power cord and switch the power on.
4. Place one hand behind your back, and with your other hand grasp only the plastic spokes of the **yoke collar**. Rotate the **yoke collar** until the top and bottom edges of the picture appear parallel with the top and bottom edges of the bezel. (**Do not move the magnets, which are preset by the manufacturer and should not be adjusted.**)
5. Switch the power off, unplug the computer, and discharge the CRT.
6. Hold the **yoke collar** in position and tighten the **yoke clamp screw** so that the **yoke collar** will not slip. Don't overtighten.
7. Connect the power cord and switch the power on to verify that the adjustment is still correct.
8. Replace the cover.

Macintosh and Macintosh Plus

CRT Yoke Adjustments



Centering Ring Adjustment Procedure

1. Remove the cover and discharge the CRT. Turn the computer so that the back is facing you, and place a mirror in front of the CRT screen.
2. Locate the two **centering rings** on the yoke assembly. If a bonding material is holding the rings in place, use a small mat knife to break the bonding.
3. Connect the power cord and switch the power on.
4. Rotate each ring about half a turn and observe the effect on the screen. The adjustment of the **centering rings** determines whether the picture is centered or offset to one side.
5. Center the picture by first holding the **front ring** steady and moving the **rear ring**, then holding the **rear ring** steady and moving the **front ring**.
6. When the screen is properly centered, switch the power off, unplug the computer, and replace the cover.



Macintosh and Macintosh Plus

Video Adjustments

Perform the video adjustments whenever the CRT or power/sweep board is replaced.

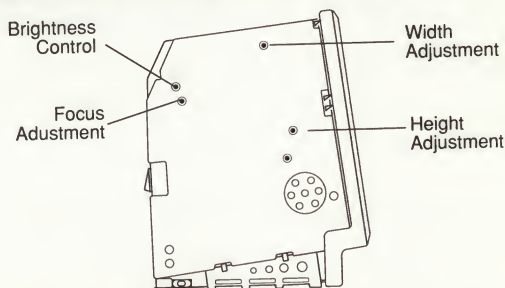


Figure: Video Adjustment Controls



WARNING: Video adjustments are performed with the power on. Review the CRT safety rules before performing these procedures.

Brightness and Contrast Adjustment Procedure

1. Remove the cover and discharge the CRT. Turn the computer so that the back is facing you and place a mirror in front of the CRT screen.
2. Connect the power cord and switch the power on.
3. Turn the **contrast control** fully clockwise.
4. Using the alignment tool, turn the **brightness control** fully counterclockwise so that white lines are visible on the screen. Then turn the **brightness control** clockwise until the white lines just disappear.
5. Turn the **contrast control** slightly counterclockwise to achieve the ideal brightness and contrast adjustment.

Size Adjustment Procedure

1. Use the plastic alignment tool to adjust the **width** until the raster is approximately 7 inches wide.
2. Use the alignment tool to adjust the **height** until the raster is approximately 4.7 inches high.

Focus Adjustment Procedure

1. Turn the **focus adjustment** fully clockwise. Then turn the **focus adjustment** back (counterclockwise) one-eighth of a turn.
2. Switch the power off, unplug the computer, and replace the cover.

Macintosh and Macintosh Plus

Symptom/Cure Chart



Video Problems

Solutions

No video, but audio tone is present and drive operates

1. Turn contrast control fully clockwise.
2. Check video cable.
3. Replace neck cable.
4. Replace power/sweep board.
5. Replace logic board.

Screen is bright and audio is present, but no video information is present

1. Replace power/sweep board.
2. Replace logic board.

Drive Problems

Solutions

Disk ejects; display shows disk icon with blinking "X"

1. Replace bad disk.
2. Replace disk drive cable.
3. Replace disk drive.
4. Replace logic board.

Unable to insert disk all the way

1. Power off the system and hold mouse button down while switching power back on to ensure eject cycle has been completed.
2. Replace disk drive.

Drive will not eject disk

1. Hold down <Shift> and <Command> keys and press 1 (for the internal drive) or 2 (for external drive).
2. Pull down File menu and select **Eject**. Attempt this two or three times.
3. Eject disk manually by pushing opened paper clip into hole beside drive slot.
4. Replace disk drive.

Will not read disks on internal or external drive

1. Replace bad disk.
2. Replace disk drive cable.
3. Replace Mylar RFI shield.
4. Replace disk drive.
5. Verify ROMs on logic board.
6. Replace logic board.

Audio tone sounds at power on, video is present, but drive does not operate

1. Replace disk drive cable.
2. Replace disk drive.
3. Replace logic board.

Drive continually ejects disk

1. Check disk drive cable. **See Internal Disk Drive Cable Compatibility in General Information.**
2. Replace disk drive.



Macintosh and Macintosh Plus Symptom/Cure Chart

Drive Problems (continued)

Solutions

Disk drive runs
continuously

1. Replace bad disk.
2. Replace disk drive cable.
3. Replace disk drive.
4. Replace logic board.

400K drive
will not boot

1. If logic board has Rev. A ROMs and drive stepper motor is serial number F518 or higher, upgrade to Rev. B ROMs.
2. Replace disk drive.

Peripheral Problems

Solutions

Cursor does not
move

1. Connect mouse.
2. Replace mouse.
3. Replace logic board.

Cursor moves but
clicking mouse
produces no
response

1. Replace mouse.
2. Replace logic board.

No response to any
key on the keyboard

1. Replace keyboard cable.
2. Replace keyboard.
3. Replace logic board.

No response from
a particular key

1. Replace keyswitch.
2. Replace keyboard.
3. Replace logic board.

Known-good
ImageWriter, or
ImageWriter II
will not print

1. Make sure Chooser and Control Panel are set correctly.
2. Replace software with known-good software.
3. Replace printer interface cable.
4. Replace logic board.

Known-good
LaserWriter
will not print

1. Make sure Chooser and Control Panel are set correctly.
2. Replace software with known-good software.
3. Refer to Networks tab in *Apple Service Technical Procedures*.

Macintosh and Macintosh Plus

Symptom/Cure Chart



Miscellaneous Problems

Solutions

When turned on, Macintosh Plus continuously beeps and tries to power up

1. Check power/sweep voltage.
2. Replace power/sweep board, logic board, and internal drive; then turn on Macintosh Plus.
Replacing only the power/sweep board may damage the new power/sweep board.

Clicking or chirping sound

1. Connect logic board cable.
2. Perform voltage adjustment.
3. Replace power/sweep board.
4. Replace logic board.

Smoke/odor issues from computer

- Replace power/sweep board.

No video, no audio tone, and no drive operation

1. Connect power cord.
2. Turn power on.
3. Replace power cord.
4. Check fuse.
5. Replace power/sweep board.
6. Replace logic board.

MacTest displays 128K/512K when 1 MB Macintosh Plus is tested

- Replace Macintosh Plus logic board.

When developer's switch is installed, Macintosh Plus resets intermittently

- Remove switch and file it down 1/16 of an inch.

Macintosh Plus hangs on startup

- Check ROMs. If ROMs 342-0341-A or B (ROM HI) and 342-0342-A (ROM LO) are installed on logic board and peripheral device is connected to SCSI port, turn on peripheral device before switching on computer.

Macintosh 512K enhanced has two RFI shrouds

- Some machines have two RFI shrouds installed. Replace two RFI shrouds with one RFI shroud.



Macintosh and Macintosh Plus

Macintosh Plus Kits

Things To Remember

1. Before working inside the Macintosh, discharge the CRT to the metal ground lug. Failure to do so can result in damage to the logic and power/sweep boards (**see Discharging and Disposing of the CRT under Safety**). Use the CRT discharge tool (**see Special Tools Index under General Information**).
2. After installing the Disk Drive Kit, return the old ROMs and the 400K disk drive to Apple.
3. After installing the Logic Board Kit, return the 128/512K logic board, the old RFI shield, and the old cover to Apple.

800K Disk Drive Kit Installation Procedure

1. Remove the cover and the RFI shield, and discharge the CRT to the metal ground lug.
2. Remove the logic board. Using an IC extractor, remove the two ROMs installed at locations D5 and D8.
3. Install the two **new** ROMs in the appropriate locations on the logic board. The notch at the end of each ROM should face the front of the machine.

<u>ROM</u>	<u>P/N</u>	<u>Location</u>
HI	342-0341	D5
LOW	342-0342	D8

4. Remove the internal disk drive.
5. Install the logic board and the new 800K internal disk drive.
6. Install the RFI shield and the cover.

Logic Board Kit Installation Procedure

1. Remove the cover and the RFI shield, and discharge the CRT to the metal ground lug.
2. Remove the **128K/512K** logic board. Using an IC extractor, remove the two ROMs installed at locations D5 and D8.
3. Install the ROMs in the appropriate locations on the new **1 MB** logic board. The notch at the end of each ROM should face the front of the machine.

<u>ROM</u>	<u>P/N</u>	<u>Location</u>
HI	342-0341	D5
LOW	342-0342	D8

4. Install the new **1 MB** logic board, the new RFI shield, and the new cover.

Macintosh and Macintosh Plus

Macintosh Plus Memory Upgrade



The Macintosh and Macintosh Plus require 150-ns (or faster) SIMMs. RAM speed is indicated by the -xx number after the manufacturer's part number (-15 indicates a 150-ns SIMM). SIMMs are available in 256K and 1 MB RAM sizes. Adding memory to a Macintosh and Macintosh Plus requires that you configure the logic board as shown in the Figure and chart below.

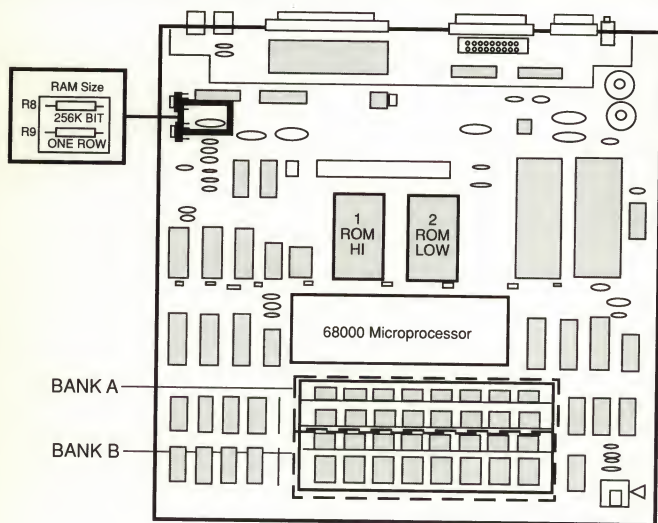


Figure: Macintosh Plus 1 MB Logic Board

Upgrade Procedure

1. Clip or install the needed resistor (see chart below).
2. Remove/install the SIMMs as indicated in the chart below. Use the SIMM removal tool (see **Special Tools Index** under **General Information**).

RAM	Resistors	SIMMs
1 MB	R8 installed R9 removed	2—256K SIMMs (Bank A) 2—256K SIMMs (Bank B)
2.5 MB	R8 removed R9 removed	2—1 MB SIMMs (Bank A) 2—256K SIMMs (Bank B)
4 MB	R8 removed R9 removed	2—1 MB SIMMs (Bank A) 2—1 MB SIMMs (Bank B)



Macintosh and Macintosh Plus

ROM Upgrade & ROM Compatibility

To be compatible with the current 400K disk drive stepper motor, the 128K/512K Macintosh should have ROM HI 342-0220-B at location D5, and ROM LOW 342-0221-B at location D8. If these ROMs are not installed, upgrade the logic board by replacing the boot ROMs as shown below.

ROM Upgrade Procedure

1. Power off the Macintosh, remove the power cord and cover, and discharge the CRT. Use the CRT discharge tool (see **Special Tools Index under General Information**).



WARNING: Failure to follow the rules for safe CRT discharge could result in serious injury or property damage. The Macintosh CRT must be discharged to the ground lug to prevent damage to the logic board.

2. Put on your grounding wriststrap and place the Macintosh on a grounded workbench pad.
3. Remove the logic board and verify old ROMs are installed.
4. Using an IC extractor, remove the old ROMs.
5. Install the new ROMs in the appropriate location—ROM HI (P/N 342-0220-B) at location D5, ROM LOW (P/N 342-0221-B) at location D8. The notch at the end of each ROM should face the front of the machine on installation.
6. Replace the Macintosh logic board and the cover.
7. Run *MacTest* to verify correct operation.

ROM Compatibility for 800K Drives

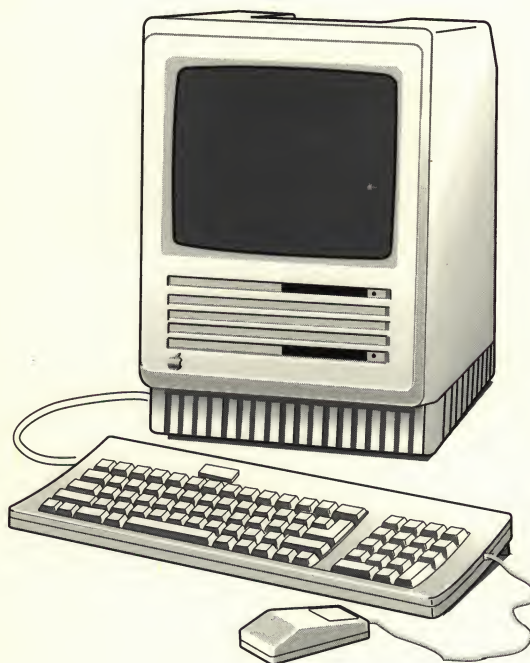
The 512K logic board (P/N 661-96236) is shipped with a high-boot ROM (P/N 342-0220) and a low-boot ROM (P/N 342-0221) that support only the 400K disk drive. When the 512K logic board is used to replace a defective 512K enhanced logic board or a defective 512K logic board with a 800K disk drive, you must replace its ROMs with ROMs from the customer's logic board. The customer's ROMs, which support 800K disk drive systems, will have part numbers 342-0341 (high-boot ROM) and 342-0342 (low-boot ROM).

Also, newer Macintosh 512K enhanced and Macintosh Plus systems and the 800K disk drive upgrade kit have revised high-boot and low-boot ROMs that correct the SCSI device problems of older ROMs. The newer ROMs are compatible with 512K systems, but you cannot mix old and new ROMs. This list gives the part number and the version letter of the old and new ROMs:

	Old ROMs	New ROMs
High Boot:	342-0341-A 342-0341-B	342-0341-C
Low Boot:	342-0342-A	342-0342-B



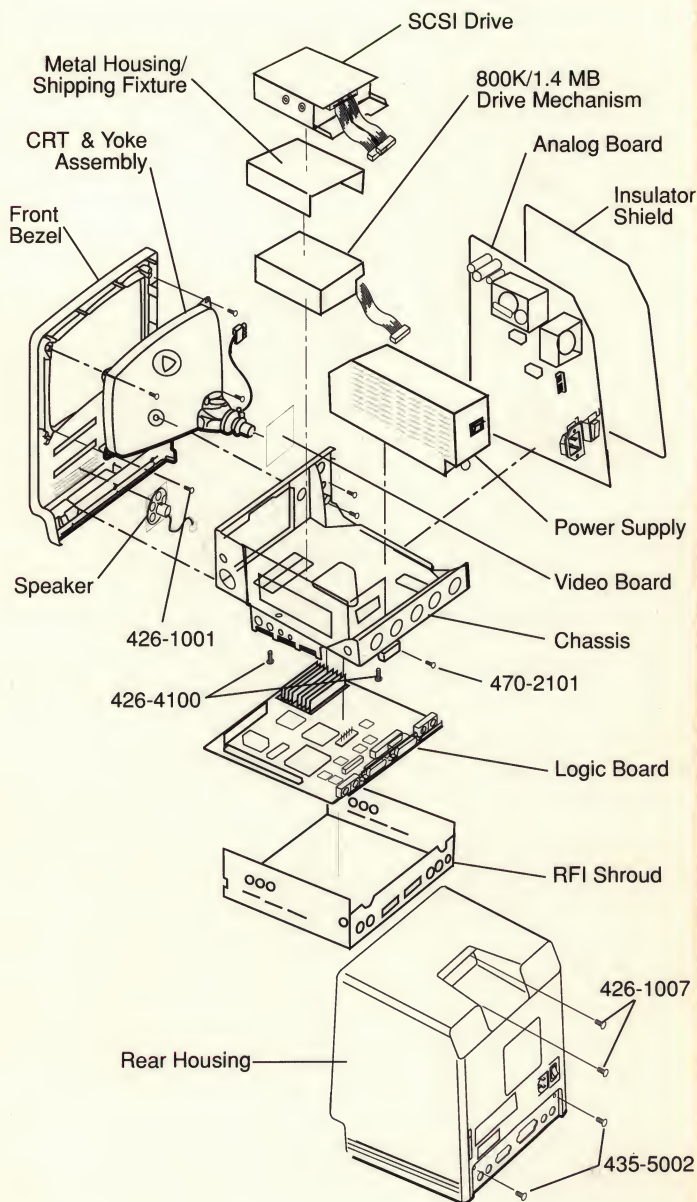
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Macintosh SE and Macintosh SE/30

Exploded View



Macintosh SE and Macintosh SE/30

Logic Board Identification

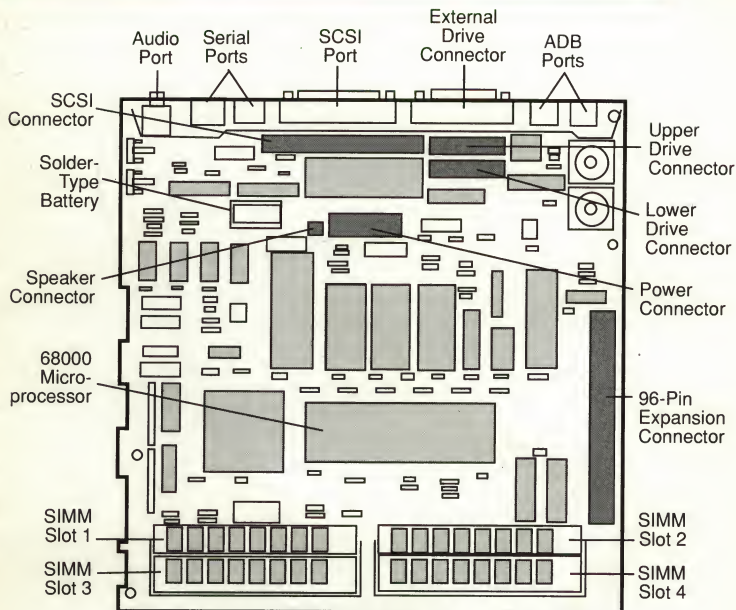


Figure: Macintosh SE Logic Board

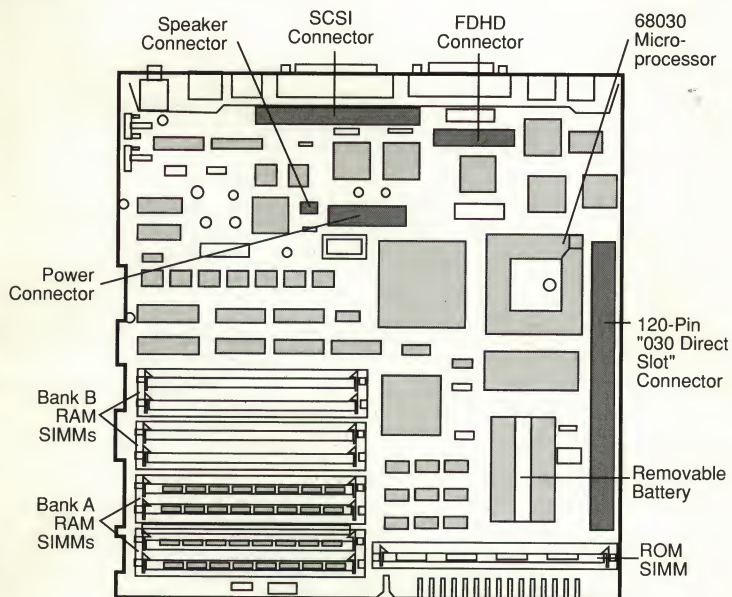


Figure: Macintosh SE/30 Logic Board



Macintosh SE and Macintosh SE/30 Specifications

Macintosh SE Specifications	
Microprocessor	MC68000 32-bit internal architecture 7.83 MHz clock frequency
Memory	1 or 2 MB of RAM, expandable to 4 MB 256K of ROM 256 bytes of parameter memory
Video Display	Built-in 9-inch diagonal, high-resolution, 512- by 342-pixel, bit-mapped display
Interfaces	Two Apple Desktop Bus™ (ADB) ports Two RS-232/RS-422 serial ports SCSI interface One DB-19 external disk drive port Macintosh SE internal expansion slot One sound port
Internal Storage	One 1.4 MB, FDHD™ SuperDrive™ (800K drive in older versions of the SE) Optional second FDHD SuperDrive (800K drive in older versions of the SE) Optional internal Hard Disk 20SC, 40SC
Sound	Four-voice sound with 8-bit digital/analog conversion using 22-KHz sampling rate
Clock/Calendar	CMOS custom chip with seven-year battery
Electrical	Line voltage: 90 to 140 VAC; 170 to 270 VAC Frequency: 47 to 63 Hz Maximum power: 100 watts

Macintosh SE and Macintosh SE/30

Specifications



Macintosh SE/30 Specifications

Microprocessor	MC68030 32-bit internal architecture 15.667 MHz clock frequency Built-in paged memory management unit (PMMU) 256 byte instruction and data caches
Coprocessor	MC68882 floating-point unit
Memory	1 or 4 MB of RAM, expandable to 8 MB 256K of ROM 256 bytes of user-settable parameter memory
Video Display	Built-in 9-inch diagonal, high-resolution, 512- by 342-pixel, bit-mapped display Color QuickDraw™ in ROM provides support for grayscale and color video cards installed in the 030 direct slot
Interfaces	Two Apple Desktop Bus (ADB) ports Two RS-232/RS-422 serial ports SCSI interface 030 direct slot supporting full 32-bit address and data lines through 120-pin Euro-DIN connector Stereo sound port for external audio amplifier One DB-19 external disk drive port
Internal Storage	One 1.4 MB, FDHD SuperDrive Optional internal Hard Disk 40SC, 80SC
Sound	Apple sound chip including four-voice, wave-table synthesis and stereo sampling generator Mixed stereo monophonic sound output through internal speaker
Clock/Calendar	CMOS custom chip with long-life battery
Electrical	Line voltage: 120 to 240 VAC, RMS automatically configured Frequency: 48 to 62 Hz, single phase Maximum power: 75 watts



Macintosh SE and Macintosh SE/30

Parts List

800K Mechanism, Apple 3.5 Drive	661-0345
1.4 MB Mechanism, Apple 3.5 Drive	661-0474
Disk Drive Parts	
Back Plate, Drive 2	805-0914
Cable, 3.5 Internal Drive (red or yellow stripe)	590-0188
Cable, 3.5 Internal Drive (yellow stripe)	590-0437
Metal Housing/Shipping Fixture	805-5050
Packing Disk, 2-sided (for transporting)	003-0003
Screw, M 3.5 x .6 x 8, PNCR Rec	462-4100
Screw, M 3 x 6, with two washers	462-3401
Service Packaging, 800K/1.4 MB Drive	602-0210
Analog Board, Macintosh SE & SE/30	661-0371
Brightness Knob	865-0047
Fan Kit	076-0311
Fastener, Snap-in Plastic	830-0240
Insulator, Analog Board	725-0020
Lower Ground Clip	805-0576
Screw, M 3 x 5 x 10 PNCR	416-1310
Screw, M 3 x .5 x 6	462-3100
Screw, M 2.9 x 10	470-2101
Washer, Lock, Internal Tooth	860-0282
Cable, Power AC	590-0380
Chassis, Macintosh SE and SE/30	805-0938
Bracket, Macintosh SE and SE/30	805-0939
Screw, M 2.9 x 10	470-2101
CRT and Yoke Assembly	076-0103
Ferrite Bead, Clamp-on	159-0061
Screw, Tap, M 4.22 x 1.41 x 16, Pan, Torx, Zinc (CRT & Chassis)	426-1001
Extended Keyboard	661-0384
Extended Keyboard, French	F661-0384
Extended Keyboard, Fr Canadian	C661-0384
Extended Keyboard, German	D661-0384
Extended Keyboard, Italian	T661-0384
Extended Keyboard, Spanish	E661-0384
Extended Keyboard Parts	
Alps Locking Keyswitch	970-1263
Bottom Case	815-1019
Key Cap Set	658-7010
Keyboard Cable, 1 meter	590-0361
Keyswitch Set (of 10), ADB Keyboard	076-0209
Top Case	815-1018
Front Bezel with Speaker, Slot Cover, Macintosh SE (800K)	810-0399
Front Bezel with Speaker, Slot Cover, Macintosh SE (FDHD)	810-0422
Front Bezel with Speaker, Macintosh SE/30 (800K)	630-5499
Logo Plate Label, Macintosh SE & SE/30	825-1256
Slot Cover Bezel, Macintosh SE	630-5330
Slot Cover Retainer, Macintosh SE	805-0908
Speaker	600-0393
HDA, 20 MB, Internal 3.5 SCSI	661-0373
HDA, 40 MB, Internal 3.5 SCSI	661-0464
HDA, 80 MB, Internal 3.5 SCSI	661-0600
Cable, HDA I/O	590-0211
Cable, HDA LED (red)	590-0237

Macintosh SE and Macintosh SE/30

Parts List



Cable, Internal Power, HDA	590-0505
Frame, HDA, Internal, 3.5 SCSI	805-5066
Service Packaging, 3.5 HDA	602-0164
ISO Keyboard, French	F661-0454
ISO Keyboard, German	D661-0454
ISO Keyboard, Italian	T661-0454
Keyboard, Regular Apple	661-0383
Keyboard, French Canadian	C661-0383
Keyboard, Spanish	E661-0383
Keyboard Parts	
Alps Locking Keyswitch	970-1263
Case Bottom	815-1017
Key Cap Set	658-7011
Keyboard Cable, 1 meter	590-0361
Keyswitch Set (of 10), ADB Keyboard	076-0209
Top Case	815-1016
Logic Board, Macintosh SE (replaced by 661-0526)	661-0369
Logic Board, Macintosh SE (rev., replaced by 661-0526)	661-0490
Logic Board, Macintosh SE 800K (w/o RAM)	661-0526
Lithium Battery (with Leads)	742-0009
Lithium Battery (w/o Leads)	742-0010
IC, ROM, HI	342-0701
IC, ROM, LOW	342-0702
IC, SWIM	344-0062
Resistor, 150 Ohms, .25W, $\pm 5\%$	101-4151
SIMM, 256K, 120 ns	661-0402
SIMM, 1 MB, 120 ns	661-0403
SIMM, DIP, 256K	661-0494
SIMM, DIP, 1 MB	661-0410
Shroud, RFI, Macintosh SE	805-5060
Logic Board, Macintosh SE/30 (replaced by 661-0527)	661-0510
Logic Board, Macintosh SE/30 (w/o RAM)	661-0527
Logic Board, Macintosh SE (FDHD) (w/o RAM)	661-0536
Battery Holder Cover	520-0344
Lithium Battery (w/o Leads)	742-0011
SIMM, 256K, 120 ns	661-0402
SIMM, 1 MB, 120 ns	661-0403
SIMM, DIP, 256K, 120 ns	661-0494
SIMM, DIP, 1 MB, 120 ns	661-0410
Shroud, RFI, Macintosh SE	805-5060
Shroud, RFI, Macintosh SE/30	805-0969
Cable, Logic Board Power Interconnect	590-0392
Mouse, Apple Desktop Bus	661-0338
Mouse Ball (25.4 mm dia)	699-8001
Mouse Ball (21.9 mm dia)	699-8038
Retainer, ADB Mouse (38 mm dia)	076-0231
Retainer, ADB Mouse (34 mm dia)	815-0816
Mouse, ADB (replacing 661-0338)	661-0479
Mouse Ball (for 661-0479)	815-1135
Retainer, ADB Mouse (for 661-0479)	815-1136
Power Supply, Macintosh SE and SE/30	661-0370
Rear Housing Assembly with Door and Feet	630-5271
Agency Approval Label, Macintosh SE	825-2021



Macintosh SE and Macintosh SE/30 Adjustments & Symptom/Cure Chart

Agency Approval Label, Macintosh SE/30	825-2043
Audio Extension Cable	590-0612
Foot, Platinum	865-0051
Rear Housing Door	815-0986
Reset/Interrupt Switch	815-1008
Screw, Tap, 8-32 x .625, Fill, Torx, Black Zinc Oxide (Main Case)	435-5002
Screw, Tap, M 4.22 x 1.41 x 16, Pan, Torx, Zinc (Main Case)	426-1007
Upper Ground Clip	805-0575
Video Board, Vertical Macintosh SE & SE/30	982-0024

Yoke and Video Adjustments

Although the exact location of the adjustment controls differs slightly, the procedures for performing yoke and video adjustments are the same on the Macintosh SE and SE/30 and on the Macintosh and Macintosh Plus. **Refer to the Macintosh and Macintosh Plus tab for these adjustment procedures.**

Macintosh SE and SE/30 Symptom/Cure Chart

Video Problems	Solutions
Screen is dark; audio and drive operate	<ol style="list-style-type: none">1. Turn brightness control clockwise.2. Check video cable.3. Replace analog board.4. Replace video board.5. Replace logic board.6. Replace CRT.
Screen is bright and audio is present but no video informaton is visible	<ol style="list-style-type: none">1. Replace analog board.2. Replace video board.3. Replace logic board.
Screen is completely dark and fan is not running	<ol style="list-style-type: none">1. Replace power supply.2. Replace analog board.
A single vertical/ horizontal line is displayed	<ol style="list-style-type: none">1. Replace analog board.2. Replace video board.3. Replace logic board.4. Replace CRT.
Vertical/horizontal bars or stripes are displayed	<ol style="list-style-type: none">1. Replace logic board.2. Replace analog board.
A white dot is displayed in center of screen	<ol style="list-style-type: none">1. Check yoke cable.2. Replace analog board.3. Replace CRT.

Macintosh SE and Macintosh SE/30

Symptom/Cure Chart



Screen jitters at top left and/or lower right

— Replace analog board.

Peripheral Problems Solutions

Cursor does not move

1. Check mouse connection.
2. If mouse was connected to a keyboard, connect it to a rear ADB port. If mouse works, replace keyboard.
3. If mouse does not work in any ADB port, replace mouse.
4. Replace logic board.

Cursor moves but clicking the mouse button has no effect

1. Replace mouse.
2. Replace logic board.

No response to any key on the keyboard

1. Check keyboard connection to rear ADB port.
2. Replace keyboard cable.
3. Replace keyboard.
4. Replace logic board.

Cannot double-click to open a disk, application, or server

1. Remove any multiple system files on hard disk.
2. Clear parameter RAM. Hold down <Shift> <Option> <Command> keys and select **Control Panel** from the Apple pull-down menu. Reset mouse controls.
3. If mouse was connected to a keyboard, connect it to a rear ADB port. If mouse works, replace keyboard.
4. If mouse does not work in any ADB port, replace mouse.
5. Replace logic board.

Known-good ImageWriter, or ImageWriter II will not print

1. Make sure the Chooser and Control Panel are set correctly.
2. Replace software with known-good software.
3. Replace printer interface cable.
4. Replace logic board.

Known-good LaserWriter will not print

1. Make sure the Chooser and Control Panel are set correctly.
2. Replace software with known-good software.
3. Refer to the Networks tab in the *Apple Service Technical Procedures*.



Macintosh SE and Macintosh SE/30

Symptom/Cure Chart

Drive Problems

Solutions

Audio and video are present, but one internal drive does not operate

1. Replace bad disk.
2. Replace internal disk drive cable.
3. Replace internal disk drive.
4. Replace logic board.

Audio and video are present, but neither internal drive operates (Macintosh SE only)

1. Replace bad disk.
2. Replace logic board.

External drive does not operate

1. Replace bad disk.
2. Be sure external drive is placed on the right side of the Macintosh.
3. Replace external drive.
4. Replace logic board.

Will not eject disk

1. Eject disk manually by pushing an opened paper clip into hole beside drive.
2. Power off system and hold mouse button down while powering back on (to complete eject cycle).
3. Replace disk drive.

Disk ejects; display shows icon with blinking "X"

1. Replace disk with known-good system disk.
2. Replace disk drive.
3. Replace logic board.

Unable to insert disk all the way

1. Eject disk manually by pushing an opened paper clip into hole beside the drive.
2. Power off system and hold mouse button down while powering back on (to complete eject cycle).
3. Replace disk drive.

Internal disk drive runs continuously

1. Replace bad disk.
2. Replace disk drive.
3. Replace logic board.
4. Replace disk drive cable.

SCSI Problems

Solutions

Internal or external hard disk will not operate

1. Verify that SCSI loopback card is not attached.
2. Replace hard disk.
3. Replace logic board.
4. Replace hard disk drive cable.

Macintosh SE and Macintosh SE/30

Symptom/Cure Chart



Works with internal or external SCSI device but will not work with both

1. Check SCSI device switch setting on the external device.
2. Replace terminator on the external device.
3. Verify that terminator is installed on the internal SCSI drive.
4. Replace SCSI device select cable.

Miscellaneous Problems

Solutions

Clicking, chirping or thumping sound

1. Verify analog board cable is connected at J12 on logic board.
2. Replace power supply.
3. Replace analog board.
4. Replace logic board.

Smoke/odor

1. Replace power supply.
2. Replace analog board.

No video, no audio and no drive operation

1. Connect power cord.
2. Turn power on.
3. Replace power cord.
4. Replace power supply.
5. Replace analog board.
6. Replace logic board.

"Sad Macintosh" icon

1. Replace bad floppy disk.
2. Replace SIMM(s) if code matches any of those in SIMM Error Codes chart (see next page).
3. Verify that three-pin jumper on logic board is configured correctly for system RAM (Macintosh SE only).
4. Replace logic board.

"Sad Macintosh" icon and black line are displayed; screeching sound

1. Verify that three-pin jumper on logic board is configured correctly for system RAM (Macintosh SE only).
2. Replace logic board.



Macintosh SE and Macintosh SE/30

Macintosh SE SIMM Error Codes

When the Macintosh SE is powered on, the ROM runs a series of logic board tests. If any of the tests fails, a "Sad Macintosh" icon and a two-row, eight-digit error code is displayed. Error codes indicating SIMM failures are shown in the table below. Identify the SIMM socket number for the type of logic board in the customer's computer and replace the bad SIMM.

Note: Paired XXs in the error codes indicate any number except 0. If the error code is unreadable, press the reset switch and watch carefully—the error code will be displayed briefly. If still unreadable, try replacing SIMMs.

Macintosh SE SIMM Error Codes

Error Code	SIMM # Solder Type ¹	SIMM # Jumper Type ²	Error Code	SIMM # Solder Type ¹	SIMM # Jumper Type ²
0000000E 000000XX	1	3	00000003 0000XX00	2	4
0000000E 00XX00XX	1	3	00000003 XX00XX00	2	4
0000000E XX00XX00	2	4	00000004 000000XX	3	1
0000000E XX00XX00	2	4	00000004 00XX00XX	3	1
00000002 000000XX	1	3	00000004 0000XX00	4	2
00000002 00XX00XX	1	3	00000004 XX00XX00	4	2
00000002 0000XX00	2	4	00000005 000000XX	3	1
00000002 XX00XX00	2	4	00000005 00XX00XX	3	1
00000003 000000XX	1	3	00000005 0000XX00	4	2
00000003 00XX00XX	1	3	00000005 XX00XX00	4	2

¹ The Macintosh SE uses both solder-type and jumper-type logic boards. To correctly locate the SIMM socket with the faulty SIMM, first identify the type of logic board in your customer's computer. This column refers to solder-type boards.

² This column refers to Macintosh SE computers with jumper-type logic boards.

Macintosh SE and Macintosh SE/30

Macintosh SE Memory Upgrade



Two logic boards are available for the Macintosh SE. The original logic board uses solder-type resistors to identify system memory configurations; the revised logic board uses a jumper to identify system memory. Also note that memory configurations requiring only two SIMMs use SIMM slots 1 and 2 on the original board, but use slots 3 and 4 on the revised board. The Macintosh SE requires 150-ns (or faster) SIMMs (indicated by the -xx number after the manufacturer's part number).

Upgrade Procedure (Solder-Type Resistors)

1. Clip or install the needed resistor (see the chart and figure below).
2. Install the SIMMs as indicated in the chart below.

RAM	Resistors	SIMMs
1 MB	R35 installed R36 removed	4—256K SIMMs
2 MB	R35 removed R36 installed	2—1 MB SIMMs (slots 1 & 2)
2.5 MB	No resistors	2—1 MB SIMMs (slots 1 & 2) 2—256K SIMMs (slots 3 & 4)
4 MB	No resistors	4—1 MB SIMMs

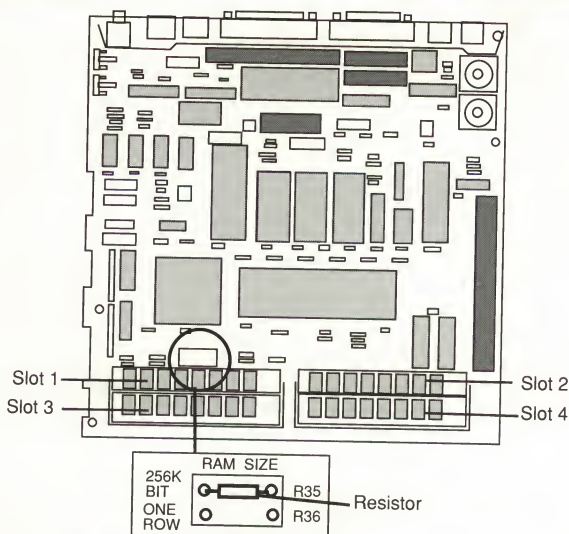


Figure: Macintosh SE Solder-Type Logic Board

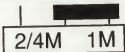
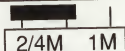
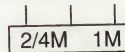
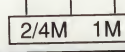


Macintosh SE and Macintosh SE/30

Macintosh SE Memory Upgrade

Upgrade Procedure (Jumper-Type Resistors)

1. Move the jumper to the appropriate pins, or remove it altogether (**refer to the chart and figure below**).
2. Install the SIMMs as shown below.

RAM	Jumpers	SIMMs
1 MB		4—256K SIMMs
2 MB		2—1 MB SIMMs (slots 3 & 4)
2.5 MB		2—1 MB SIMMs (slots 3 & 4) 2—256K SIMMs (slots 1 & 2)
4 MB		4—1 MB SIMMs

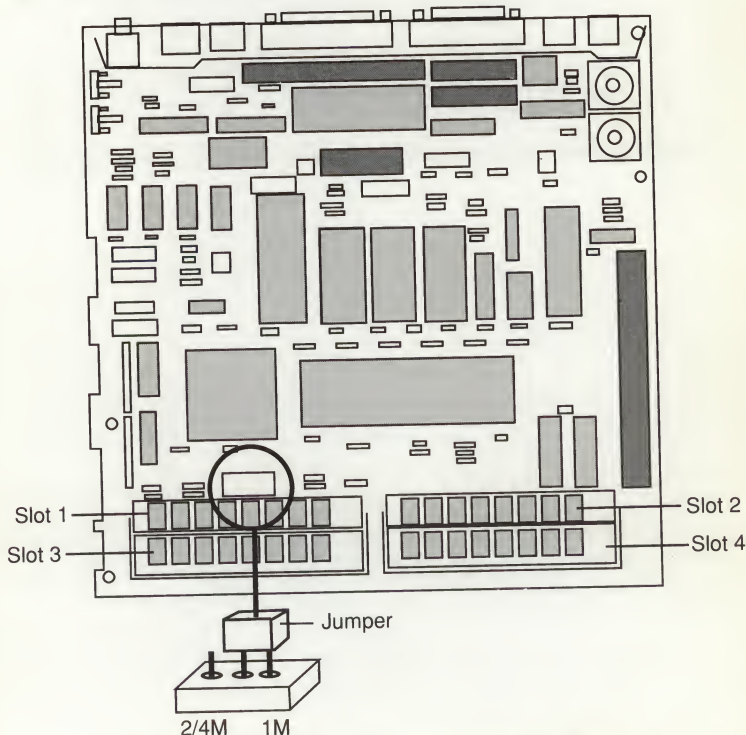


Figure: Macintosh SE Jumper-Type Logic Board

Macintosh SE and Macintosh SE/30

Macintosh SE/30 Memory Upgrade



The Macintosh SE/30 requires 120-ns (or faster) SIMM modules. Using 150-ns SIMMs will cause serious timing problems. Oversized 256K and 1 MB DIP SIMMs should be installed in Bank A only. All SIMMs in each bank must be the same memory size.

SIZE	BANK A	BANK B
2 MB	4—256K SIMMs	4—256K SIMMs
4 MB	4—1 MB SIMMs	
5 MB	4—1 MB SIMMs	4—256K SIMMs
8 MB	4—1 MB SIMMs	4—1 MB SIMMs

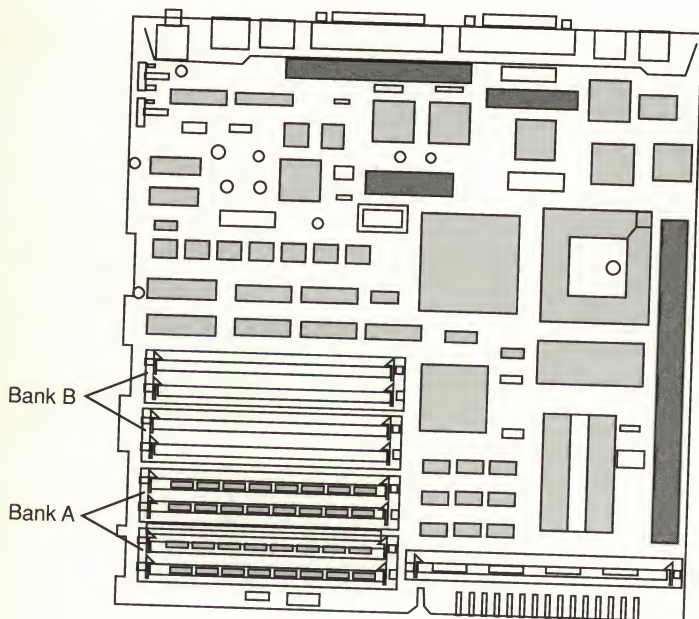


Figure: Macintosh SE/30 Logic Board



Macintosh SE and Macintosh SE/30

Macintosh SE FDHD Upgrade

Using the FDHD SuperDrive in the Macintosh SE requires using System software version 6.0.3 or higher. If the software is lower than 6.0.2, the SuperDrive will be recognized as an 800K mechanism.

Macintosh SE FDHD Upgrade

1. Remove the cover and discharge the CRT.
2. Place the Macintosh SE on the grounded workbench pad and put on your grounding wriststrap.
3. Remove the video board, the SCSI hard disk drive or upper 800K disk drive, the main logic board, and the lower 800K disk drive.
4. Using the IC extractor, remove the IWM chip at location D8 and the two ROM chips at locations D6 and D7 on the main logic board.
5. Install the SWIM chip and the two new ROMs as indicated in the following chart. The notch at the end of the SWIM chip and each ROM should face the front of the logic board (toward the SIMMs).

<u>ROM</u>	<u>P/N</u>	<u>Location</u>
SWIM	344-0062	D8
HI	342-0701	D6
LO	342-0702	D7

6. Install the FDHD SuperDrive in the lower internal drive.
7. Replace the main logic board; the SCSI hard disk, upper 800K disk drive, or second FDHD SuperDrive; the video board; and the cover.
8. Place the appropriate 1.4 MB and 800K labels in the grooves next to the upper and lower disk drive slots on the front bezel of the Macintosh SE.

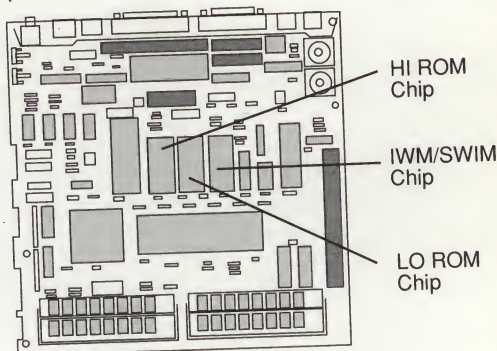


Figure: Macintosh SE Logic Board

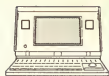
Macintosh Portable

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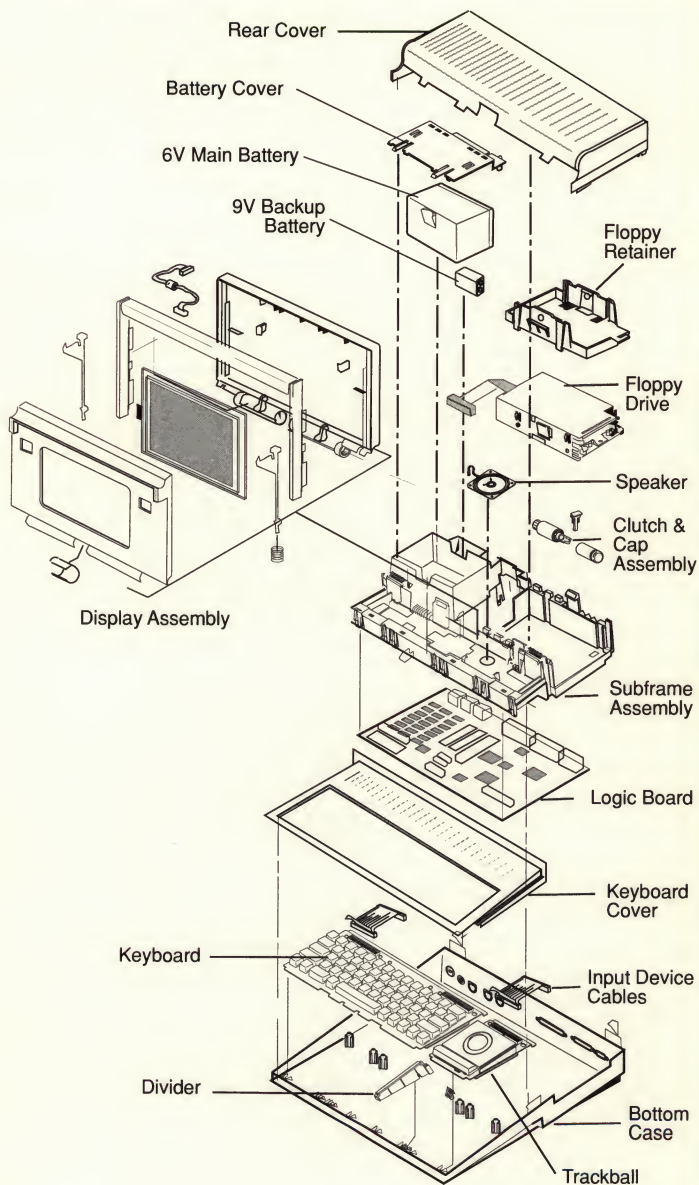
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Macintosh Portable

Exploded View



Macintosh Portable

Logic Board

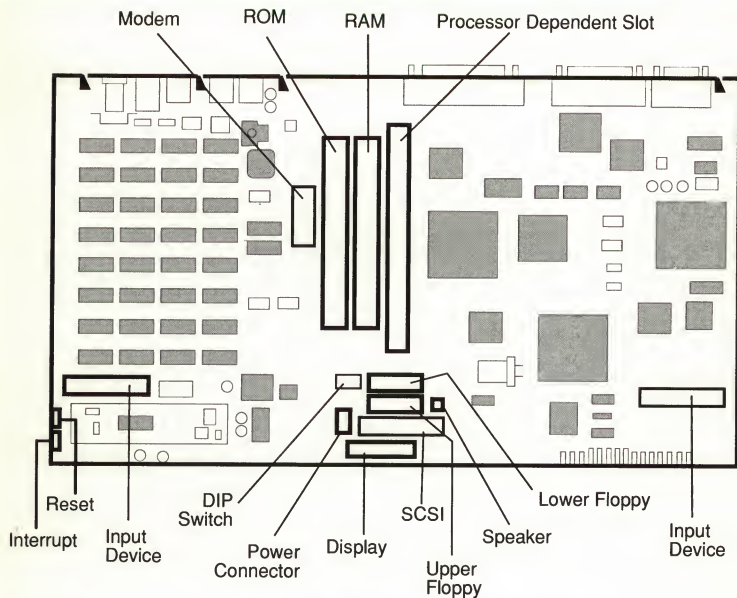


Figure: Internal Connectors and Switches

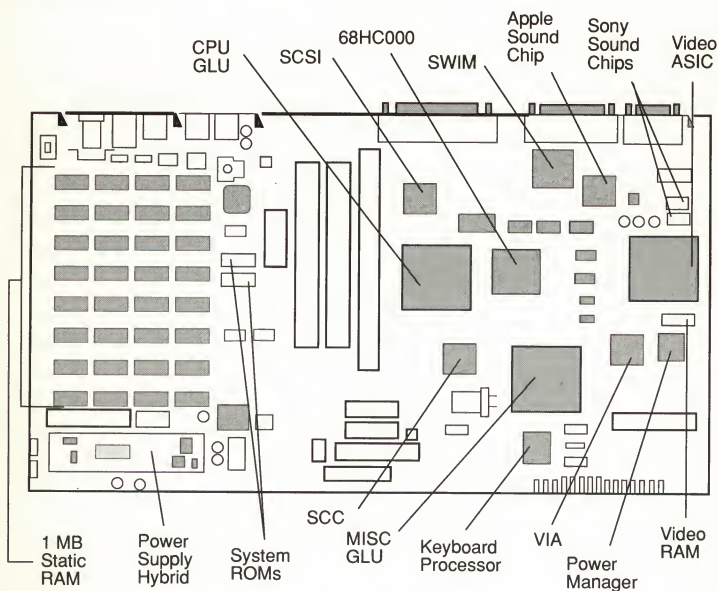


Figure: Logic Board Components



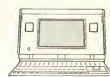
Macintosh Portable

Specifications

Macintosh Portable Specifications	
Microprocessor	CMOS 68000 16 MHz clock speed
Memory	1 MB of low-power RAM, expandable to 9 MB 256K of ROM, expandable to 4 MB
Screen	Active matrix liquid crystal display Full page width 640 by 400 pixels
Input Devices	Built-in keyboard with standard Macintosh layout Low-power ADB mouse 1.3-inch diameter trackball pointing device 18 key numeric keypad (can be installed as an alternative to the trackball)
Internal Storage	One 1.4 MB, FDHD SuperDrive Optional Internal Hard Disk 40SC
Interfaces	One external disk drive port One SCSI interface: uses a 50-pin internal connector and a DB-25 external connector One Apple Desktop Bus port allows daisy-chaining of multiple peripheral devices One stereo sound port One power adapter port Two RS-232/RS-422 serial ports One video output port
Expansion Connectors	Three expansion slots for optional RAM, ROM, or 2400 bps modem 96-pin processor direct slot
Sound	Apple custom digital sound chip
Electrical	Line voltage: 85 to 270 volts AC, 48 to 62 Hz Power: 15 watts maximum

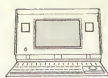
Macintosh Portable

Parts List



Macintosh Portable

1.4 MB Disk Drive	661-0474
1.4 MB Drive Shield	805-0961
FDHD Screw	844-0018
Floppy Retainer	815-1110
Floppy Bezel	815-1092
Internal 1.4 MB Drive Cable	590-0501
Battery Insulator	865-0068
Battery Pack (6V)	076-0376
Bottom Case	630-5418
Corner Foot	865-0060
Keyboard Spacer	815-1093
Modem Cap	815-1111
RFI Foam Gasket	805-0973
Flat Foot	865-0054
Carrying Case	630-5574
Carrying Case Strap	699-0508
Luggage Tag	699-0142
Display Assembly	
Case Handle	630-5071
Center Pivot Cover	815-1108
Clutch Cover	815-1098
Clutch Mechanism	699-5070
Clutch Retainer	815-1109
Display Bezel	630-5416
Display Cable	590-0502
Display Housing	630-5642
Latch Spring	805-1120
LCD Display	661-0473
External Modem/Data Access Arrangement (DAA)	
Austria, Int'l XP 2400™	AU077-0235
Belgium, Int'l XP 2400	FN077-0235
Denmark, Int'l XP 2400	DK077-0235
Finland, Int'l XP 2400	K077-0235
France, Int'l XP 2400	F077-0235
Germany, Int'l XP 2400	D077-0235
Holland, Int'l XP 2400	N077-0235
Ireland, Int'l XP 2400	EI077-0235
Italy, Int'l XP 2400	T077-0235
Norway, Int'l XP 2400	H077-0235
Spain, Int'l XP 2400	Y077-0235
Sweden, Int'l XP 2400	S077-0235
Switzerland, Int'l XP 2400	SD077-0235
United Kingdom, Int'l XP 2400	B077-0235
External Modem/DAA Cables	
Austria/Luxembourg	AU076-8369
Belgium	FN076-8369
Denmark	DK076-8369
Finland/Norway	H076-8369
France	F076-8369
Germany	D076-8369



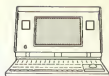
Macintosh Portable

Parts List

Holland	N076-8369
Italy	T076-8369
Spain/Ireland	Y076-8369
Sweden/Iceland	S076-8369
Switzerland	SD076-8369
United Kingdom	B076-8369
HDA, 3.5-inch, 40 MB, SCSI	661-0540
Internal Modem (Cards)	
Data Modem 2400	661-0468
Int'l XP 2400 Int Modem	661-0465
Int'l XP 2400 Int Modem, Germany	D661-0465
Keyboard	661-0476
British Keyboard	B661-0476
French Canadian Keyboard	C661-0476
German Keyboard	D661-0476
Spanish Keyboard	E661-0476
French Keyboard	F661-0476
Swedish Keyboard	S661-0476
Italian Keyboard	T661-0476
Keyboard Parts	
Keyboard Cover	815-1059
Keycap Set	658-7136
Keyswitch Set (10/pk)	076-0226
Locking Keyswitch	815-1132
Keyboard/Trackball Cable	590-0507
Logic Board	661-0470
Mouse, Low-Power	661-0585
Mouse Ball (21.9 mm)	699-8038
Retainer, ADB Mouse Ball (38 mm)	076-0231
Numeric Keypad	661-0477
Numeric Keypad, Int'l PA Version	PA661-0477
Numeric Keypad, Int'l Z Version	Z661-0477
Packaging	
Packaging, 800K/FDHD SuperDrive	602-0210
Packaging, Battery (6 V)	602-0208
Shipping Fixture, 1.4 MB Mechanism	805-5050
Power Adapter/Charger	699-0505
RAM Card, 1 MB	661-0480
Rear Cover	630-5687
Standard Bezel	810-1096
Speaker	600-0406
Subframe Assembly	630-5684
Battery Connector	805-0970
Battery Cover	630-5723
Modem RFI Gasket	805-0976
Telephone Cable, U.S.	590-0590
Trackball Assembly	661-0475
Trackball Ball	815-1133
Trackball Retainer	815-1134
Wire Harness Assembly	600-0425

Macintosh Portable

Module Replacement



Summary of Warnings and Cautions

The following warnings and cautions should be observed whenever you repair the Macintosh Portable computer. If you have not done so recently, take the time to review this important information.



CAUTION: Before replacing any modules within the Portable, always unplug the power adapter, remove the main battery, and replace the battery cover.



CAUTION: Failure to replace the battery cover could damage the computer. Replacing the battery cover disconnects the Portable from the 9-volt backup battery. Failure to do so leaves power connected to the logic board and could damage the modules being removed.



WARNING: The 6-volt sealed lead acid battery is considered toxic waste. When bad, return these batteries to Apple—do not dispose of them with other trash.



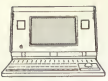
CAUTION: The Macintosh Portable makes extensive use of low-power complementary metal oxide semiconductor (CMOS) devices. These devices are very susceptible to damage from electrostatic discharge (ESD). Observe appropriate ESD precautions.



CAUTION: The LCD display is extremely susceptible to ESD damage. As with all sensitive electronics, use a grounded workstation pad and grounding wriststrap when handling the display—and handle it **ONLY** by the edges. Do not remove the protective tape on the component side of the LCD display.



CAUTION: The bottom case and sub-frame of the Portable are coated to reduce electromagnetic interference. This protective coating can be damaged by skin oils. Avoid excessive handling of these modules.



Macintosh Portable Module Replacement

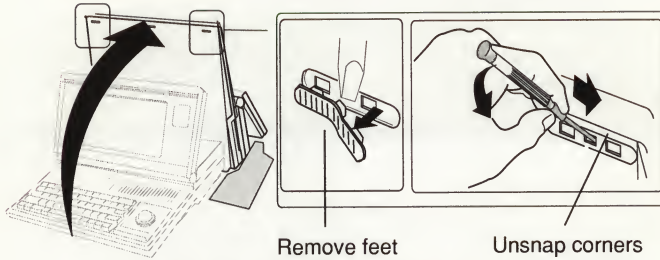


Figure: Removing the Keyboard Cover

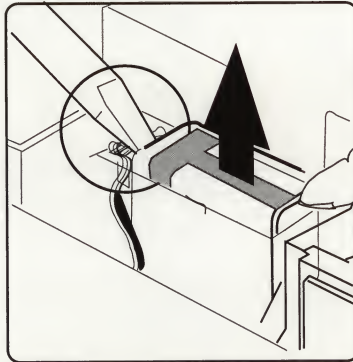


Figure: Removing the Backup Battery

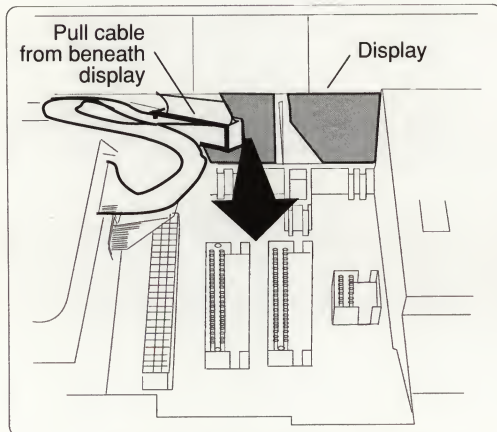


Figure: Removing the SCSI Drive

Macintosh Portable

Module Replacement



Summary of Module Removal Steps

Rear Cover

- Depress the two rear latches and lift off the rear cover.

Keyboard Cover

1. Open the display.
2. Using a small screwdriver, pop off the two feet beneath the keyboard (**see Figure**). Insert the screwdriver through the center holes, and push down and out to unsnap the corners.
3. Unsnap and remove the keyboard cover.

Main Battery

1. Remove the rear cover.
2. Slide off the battery cover.
3. Lift out the battery. If you are removing another module, replace the battery cover.

Backup Battery

Note: Removing the backup battery will erase parameter RAM. Before doing so, note all Control Panel settings so you can restore them later.

1. Access the main battery.
2. Pry up the backup battery with a small screwdriver (**see Figure**).
3. Remove the battery and disconnect its cable.

Option Cards

- Remove the main battery and replace the battery cover before removing any cards.

SCSI Drive

1. Remove the main battery and keyboard cover.
2. Remove all option cards.
3. Disconnect J19 and J18 from the logic board.
4. Close the display and slide out the disk drive cable.
5. Unsnap the two plastic latches and remove the SCSI drive.



CAUTION: When replacing the drive cable beneath the display assembly, make sure the cable does not get caught under the disk drive shield (**see Figure**).

6. After installing the new SCSI drive, be sure to run *Macintosh Hard Disk Test* to verify that the drive is operating properly.

If you are using version 1.0 of *Macintosh Hard Disk Test*, be sure to operate the computer with the power adapter connected, and do not use the "Loop on selected tests" option.



Macintosh Portable

Module Replacement

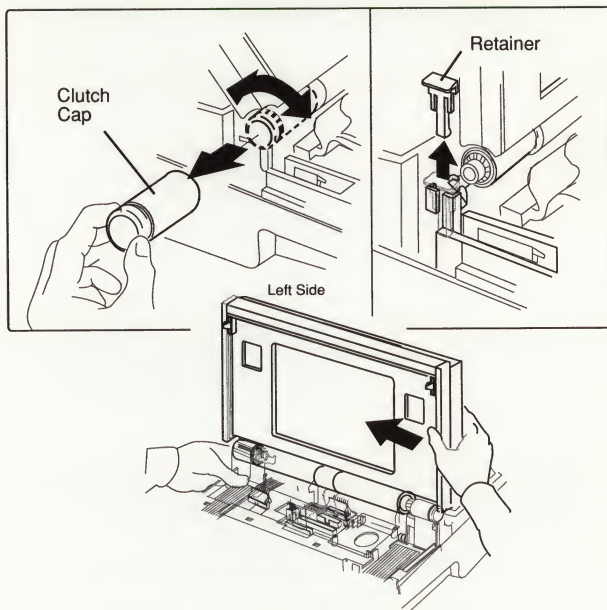


Figure: Removing the Display Assembly

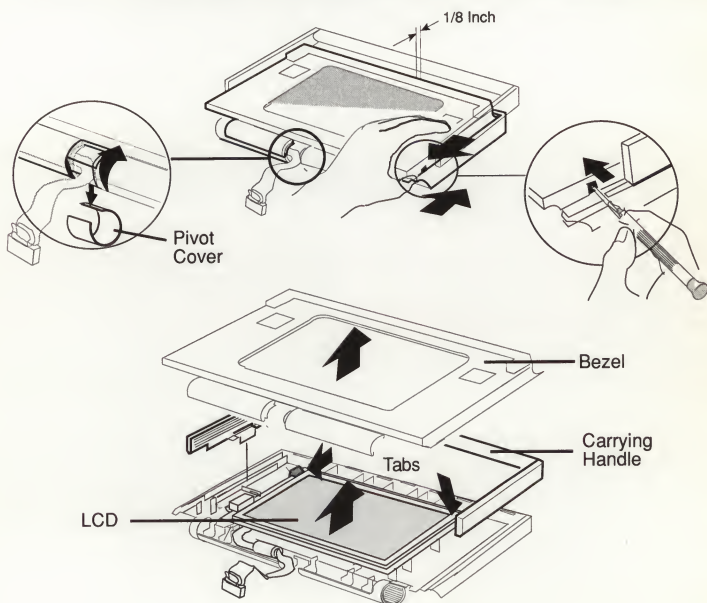
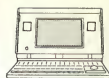


Figure: Removing the LCD Display

Macintosh Portable

Module Replacement



Upper Floppy

1. Remove the main battery and any option cards.
2. Disconnect the drive cable from the drive.
3. Unsnap the two plastic latches and remove the floppy drive.
4. Depress the two metal tabs to remove the drive mechanism.

Lower Floppy

- First remove the upper floppy or SCSI drive.

Trackball/ Numeric Keypad

1. Remove the main battery and keyboard cover.
2. Disconnect the flat cable from the device(s) to be moved.
3. Unsnap and remove the device(s) from the case.

Speaker

1. Remove the main battery and keyboard cover.
2. Disconnect the speaker cable from J16.
3. Depress the two plastic tabs and remove the speaker.

Display Assembly

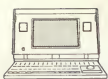
1. Remove the main battery and keyboard cover.
2. Disconnect the display cable from J19.
3. Gently twist back and forth, and remove the left clutch cap (**see Figure**).
4. Pull off the left clutch retainer.
5. As shown, push the display left and remove the left clutch mechanism.
6. Disengage the display from the right clutch mechanism and remove the mechanism.

LCD Display

1. Remove the main battery and display assembly.
2. Rotate and remove the center pivot cover.
3. Pull out the carrying handle.
4. Release the plastic bezel from the LCD display. Unhook the bezel using a screwdriver, and pull down on the LCD display (**see Figure**). Repeat on both sides.
5. Remove the bezel and carrying handle.
6. Release the two plastic clips and remove the display.
7. Disconnect the display cable.

Logic Board

1. Remove the main battery, keyboard cover, keyboard/trackball/keypad, display assembly, and option cards.
2. Disconnect all cables (if present, J13-J18 and J20) from the logic board.
3. Using a screwdriver, release the clips at the left, front center, and right sides of the subframe (**see Figure on next page**). Remove the subframe.
4. Release the eight plastic clips on the bottom of the subframe in the order shown, and separate the logic board from the subframe.



Macintosh Portable

Module Replacement

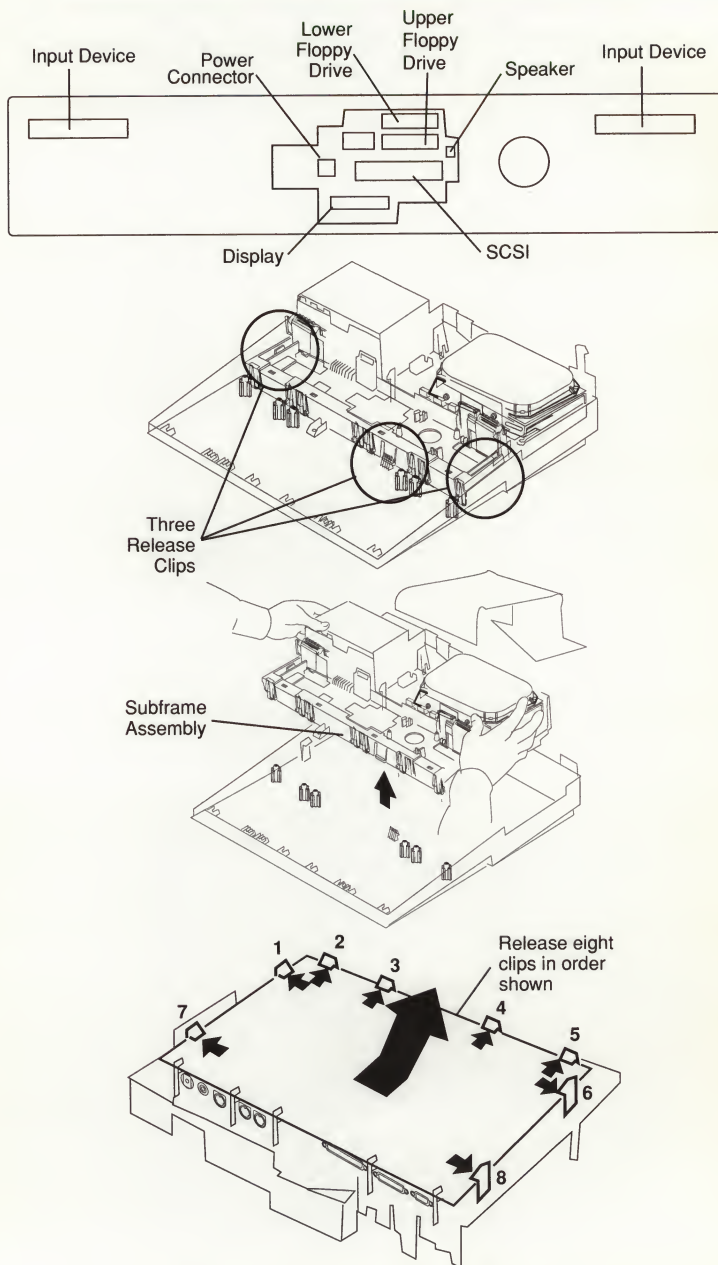
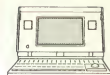


Figure: Removing the Logic Board

Macintosh Portable

Troubleshooting—Battery



Troubleshooting—Introduction

Before trying other troubleshooting aids, determine whether the Portable is receiving enough power. Perform the battery troubleshooting procedure below.

If the problem is not resolved by the suggestions in battery basics, continue troubleshooting by starting up the system and listening for the diagnostic error chords. The diagnostic error chords will indicate major problems with the logic board or battery. If this does not identify all problems, run *MacTest* if the system will boot or run *AppleCAT*® if the system will not boot. These diagnostic programs perform identical tests. If the system still doesn't function properly or will not boot, refer to the Symptom/Cure Chart. If the symptom is not listed or is not clearly defined, refer to Troubleshooting—Startup Problems. These flowcharts provide step-by-step procedures for troubleshooting the complete Portable system.

Troubleshooting—Battery Basics

Note: The power adapter by itself cannot provide enough power to operate the Macintosh Portable if the battery is not adequately charged.

1. Connect the power adapter and check the battery level. Even with the power adapter connected, the Portable must be more than 25% charged to operate properly.
2. Make sure the battery cover is completely closed. The Portable will not operate unless the battery cover is closed.
3. Press any key—you may merely have forgotten to wake the Portable up!
4. As a last resort, reset the power manager. To do this:
 - Unlock the interrupt and reset switches (**see Figure**).
 - Simultaneously press and hold the reset and interrupt switches, and then release both of them.
 - Again, wake up the Portable by pressing any key.

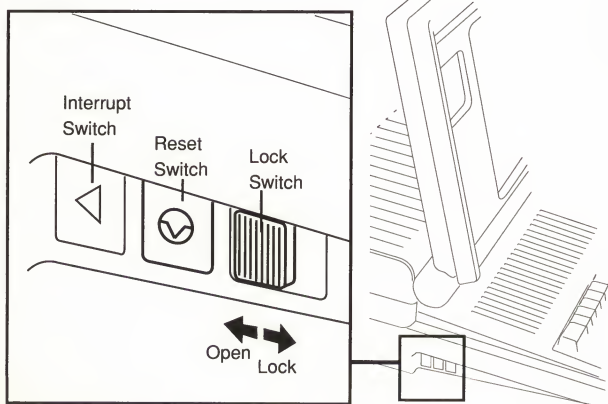
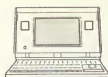


Figure: Resetting the Power Manager



Macintosh Portable

Symptom/Cure Chart

Power Problems

Screen is blank;
computer not
responding

Solutions

1. If computer is new, verify that plastic sheet has been removed from between battery and contacts.
2. Reset power manager.
3. Connect power adapter and try computer again in three or four minutes.
4. Try known-good, charged main battery. If computer now works, replace main battery.
5. Verify that keyboard cable is securely connected at both ends.
6. Replace keyboard.
7. Replace keyboard cable.
8. Replace logic board.

After main
battery removal,
some Control Panel
settings are
different

1. Was battery cover replaced when main battery was removed? If it was, power to computer was interrupted and this is normal. Restore contents of the Control Panel.
2. Replace backup battery.

Power adapter is
plugged in and
connected, but
battery DA does not
indicate charger is
connected

1. Verify charger is connected properly.
2. Try a different main battery. If battery now charges, replace main battery.
3. Replace power adapter.
4. Replace logic board.

A low-power
warning is
displayed soon
after startup

1. Battery needs recharging. Attach power adapter.
2. Make sure peripherals being used display low-power icon.
3. Reduce usage of floppy or hard disk, modem, sound, or other power-consuming devices, or connect power adapter.

Battery needs
recharging after
computer is unused
for four or more days

1. If system software 6.0.4 is being used and AppleTalk is active, using Shutdown command allows serial communications controller (SCC) to draw excess current. To prevent this, select **Sleep** from Special menu or deactivate AppleTalk using Chooser prior to **Shutdown**.
2. Install system software 6.0.5.

Video Problems

Some pixels never
come on (blacken);
no pattern

Solutions

- A maximum number of five permanently OFF pixels (voids) is considered acceptable. If display contains six or more voids, replace LCD display.

Macintosh Portable

Symptom/Cure Chart

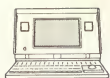


Some pixels are always black; no pattern	– If any pixel remains on constantly, replace LCD display.
A row of pixels never blackens	<ol style="list-style-type: none"> 1. Replace LCD display. 2. Replace display cable. 3. Replace logic board.
A row of pixels is always black (black streaks)	<ol style="list-style-type: none"> 1. Replace LCD display. 2. Replace display cable. 3. Replace logic board.
No display, but computer appears to be operating correctly	<ol style="list-style-type: none"> 1. Verify that display cable is securely connected. 2. Replace LCD display. 3. Replace display cable. 4. Replace logic board.
Display looks blurred	<ol style="list-style-type: none"> 1. Adjust angle of display. 2. Adjust screen contrast setting using Control Panel.
Display looks dark	<ol style="list-style-type: none"> 1. Not enough light is available. Locate computer closer to direct light or move light source closer to computer. 2. Adjust screen contrast setting using Control Panel. 3. Replace LCD display. 4. Replace logic board.
Display is too light	<ol style="list-style-type: none"> 1. Adjust angle of display. 2. Adjust screen contrast setting using Control Panel. 3. Replace LCD display.

Disk Drive Problems

Solutions

Audio and video present, but internal drive does not operate	<ol style="list-style-type: none"> 1. Try different floppy disk. 2. Replace floppy disk drive. 3. Replace floppy disk drive cable. 4. Replace logic board.
Disk ejects while booting; display shows Mac icon with blinking "X"	<ol style="list-style-type: none"> 1. Try known-good system disk. 2. Replace floppy disk drive. 3. Replace floppy disk drive cable. 4. Replace logic board.
Disk initialization fails	<ol style="list-style-type: none"> 1. Verify that Apple-certified media are being used. 2. Try different disk. 3. Replace floppy disk drive. 4. Replace logic board.



Macintosh Portable

Symptom/Cure Chart

Disk Drive Problems (continued)

Solutions

Disk will not eject

1. Shut down computer, press and hold down trackball or mouse button, and switch on computer.
2. Eject disk manually by pushing opened paper clip into bottom case hole located near disk drive.
3. Replace floppy disk drive.
4. Replace floppy disk drive cable.
5. Replace logic board.

SCSI Drive Problems

Solutions

Internal hard disk will not operate

1. Verify that SCSI hard drive cable is securely connected.
2. Use HD SC Setup to see if drive is visible. If it is, reinitialize drive.
3. Replace hard disk drive.
4. Replace logic board.

Peripheral Problems

Solutions

After connecting external SCSI device, computer no longer boots

1. Turn on external SCSI device before starting up computer.
2. Verify that proper cable termination is provided.
3. Verify that no two SCSI devices have same device address.
4. Replace logic board.

Cursor does not move when using trackball

1. Reset power manager.
2. Check cable connections between trackball and logic board.
3. Replace trackball cable.
4. Replace trackball.
5. Replace logic board.

Cursor intermittently does not move or moves erratically

- Clean trackball ball and internal rollers.

Cursor does not move when using mouse

1. Check mouse connection to ADB port.
2. Reset power manager.
3. Clean mouse ball and inside mouse case. (Refer to You Oughta Know tab in *Apple Service Technical Procedures*.)
4. Replace mouse.
5. Replace logic board.

Macintosh Portable

Symptom/Cure Chart



Device connected to modem port doesn't work

1. Verify that **External Modem** is selected in Portable CDEV.
2. If using System 6.0.4, upgrade to 6.0.5 or later.
3. Replace logic board.

Cursor moves, but clicking button has no effect

1. If trackball button is not working, replace trackball cable. If mouse button is not working, replace mouse.
2. Replace trackball.
3. Replace logic board.

No response to any key on keyboard

1. If screen is blank and you are trying to bring computer out of system sleep, try resetting power manager.
2. Check keyboard connection to logic board.
3. Replace keyboard.
4. Replace logic board.

Known-good ImageWriter, ImageWriter II, LQ, or LaserWriter will not print

1. Make sure System 6.0.5 is being used.
2. Make sure Chooser is set correctly.
3. Try another printer. If that printer works, computer is OK. Refer to *Networks* tab in *Apple Service Technical Procedures*.
4. Replace logic board.

Serial devices are unrecognized or garbage is transmitted and/or received

1. If System 6.0.4 is being used, be sure Macintosh Portable INIT 1.0 is installed in system folder.
2. Upgrade to System 6.0.5 or later.

When using external modem, after exiting communication program and putting Portable to sleep three or four times, computer locks-up when coming out of system sleep

- If System 6.0.4 is being used, upgrade to System 6.0.5 or later.

Internal Modem Problems

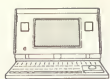
Solutions

Internal modem options do not appear in Portable CDEV when modem is installed

1. Try removing and reseating card.
2. Replace modem card.
3. Replace logic board.

Modem interferes with system sound

1. Replace modem card.
2. Replace logic board.



Macintosh Portable

Symptom/Cure Chart

Internal Modem Problems (cont'd.)

Solutions

Modem does not respond properly to AT command set instructions

1. Check baud rate and data format settings. Are they compatible with Portable Data Modem 2400 and remote modem?
2. Replace modem card.

Modem does not respond to incoming call

1. If system does not respond to incoming call during sleep mode, verify that **When Phone Rings** option in Automatic Wake-up section of Portable CDEV is selected.
2. Replace modem card.
3. Replace logic board.

Modem has no sound output

- Replace modem card.

Miscellaneous Problems

Solutions

Screen goes blank and computer shuts down every few minutes

- Computer is going into system sleep to conserve battery power. Adjust sleep delays in Control Panel or connect power adapter.

Some applications seem to run slower after running for a few seconds

- Computer is switching to system rest. To disable system rest, open Control Panel, hold down <Option> key, and click anywhere on words **Minutes Until Automatic Sleep**. When dialog box appears, click on **Don't Rest**.

Hard disk is slow to respond or screen goes blank too often

- The computer is powering down hard disk or going into system sleep to conserve battery power. Adjust sleep delays in Control Panel or connect power adapter.

No sound from speaker

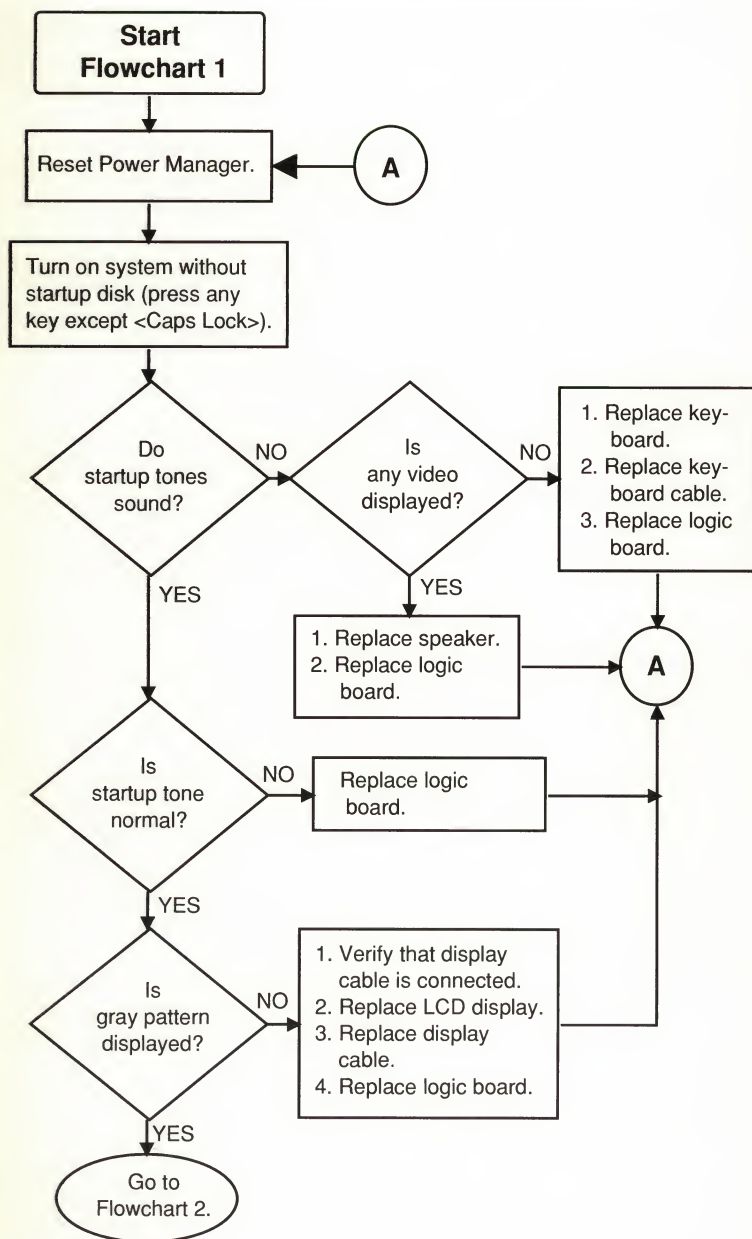
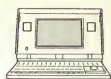
1. Verify that volume setting in the Control Panel is 1 or above.
2. Check speaker connection to logic board.
3. Replace speaker.
4. Replace logic board.

Screen suddenly goes blank

- Computer has gone into system sleep to conserve battery power.

Macintosh Portable

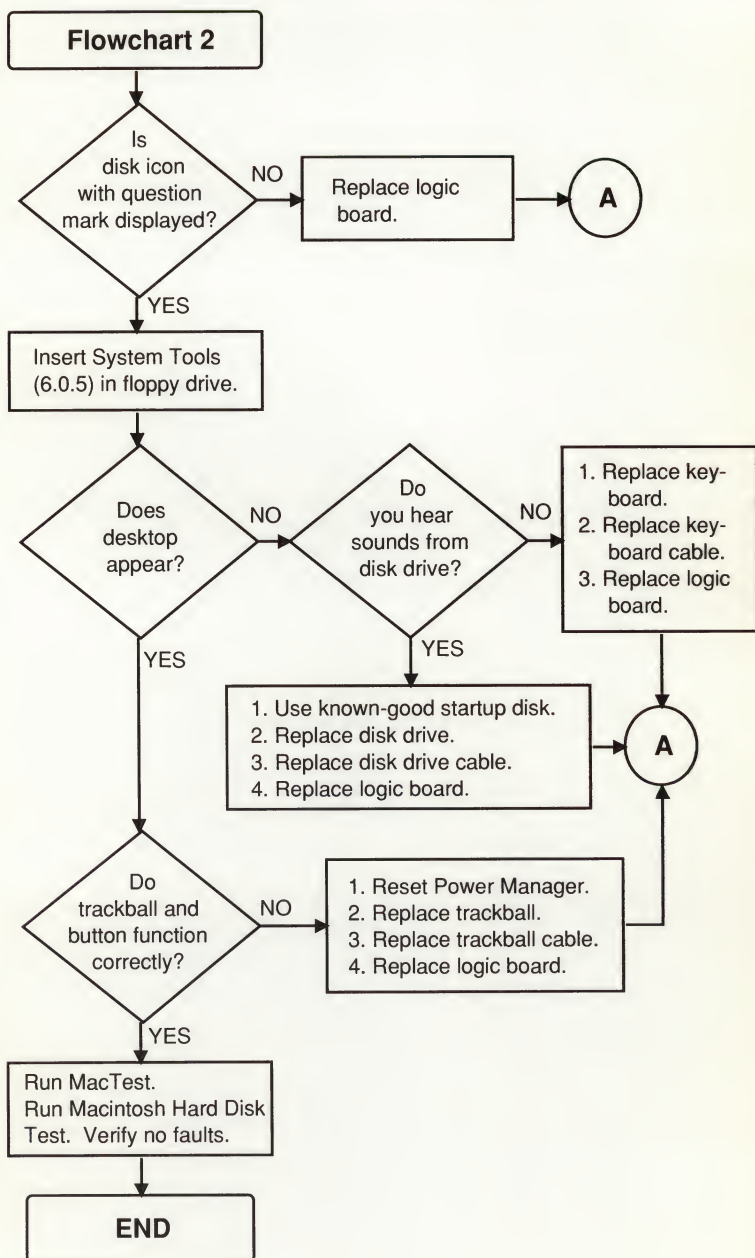
Troubleshooting—Startup Problems





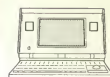
Macintosh Portable

Troubleshooting—Startup Problems



Macintosh Portable

Portable Data Modems



Installation and Verification Procedure

The following procedure covers the installation and verification of the internal, Macintosh Portable Data Modem 2400 and International XP 2400.

1. Unplug the power adapter, and remove the rear cover and main battery.
2. Remove the modem cap by pushing it through the rear of the computer.
3. Install the modem card in the modem connector. Make sure the modem card is on the right side of the modem gasket.
4. Replace the main battery and rear cover, and turn on the computer.
5. Use *ModemTest* to verify that the computer and modem are communicating, and AppleLink to verify operation of the modem with the telephone network. (For additional information, refer to Section 4, Diagnostics, under the Modems tab in *Apple Service Technical Procedures*.)

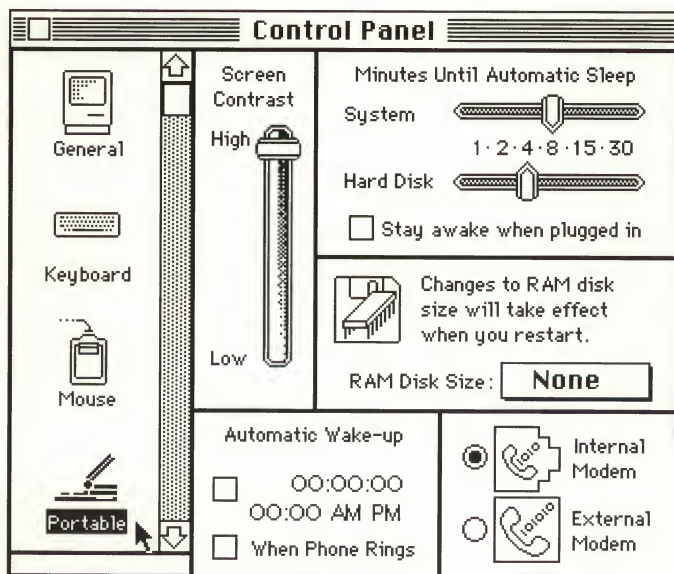
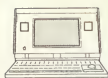


Figure: Verifying Correct Modem Installation



Macintosh Portable

Memory Upgrade

1 MB RAM Expansion Card Installation Procedure

1. Place the Macintosh Portable on a grounded workbench pad and put on your grounding wriststrap.
2. Unplug the power adapter, and remove the rear cover and main battery.
3. Replace the main battery cover.
4. Locate the RAM expansion connector.
5. Position the 1 MB RAM Expansion Card over the connector and plug in the card (see Figure).
6. Remove the battery cover and replace the main battery.
7. Replace the rear cover.

Troubleshooting the Installation

1. Turn on the computer by pressing any key except <Caps Lock>.
2. Pull down the Apple menu and select **About the Finder™**.
3. Check that the amount of RAM indicated is 2048K:
 - If the amount of RAM is *not* 2048K, replace the card.
 - If the amount of RAM indicated is *still not* 2048K, replace the logic board.

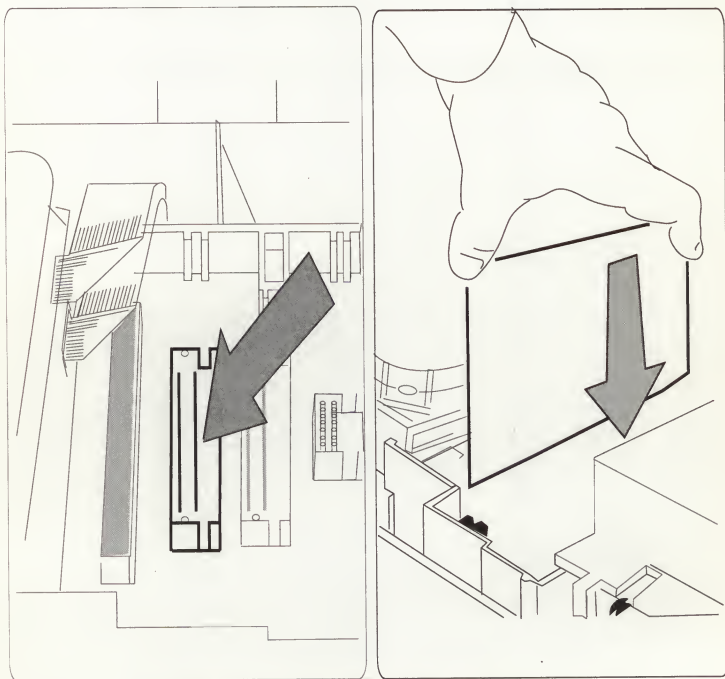


Figure: Installing 1 MB RAM Expansion Card

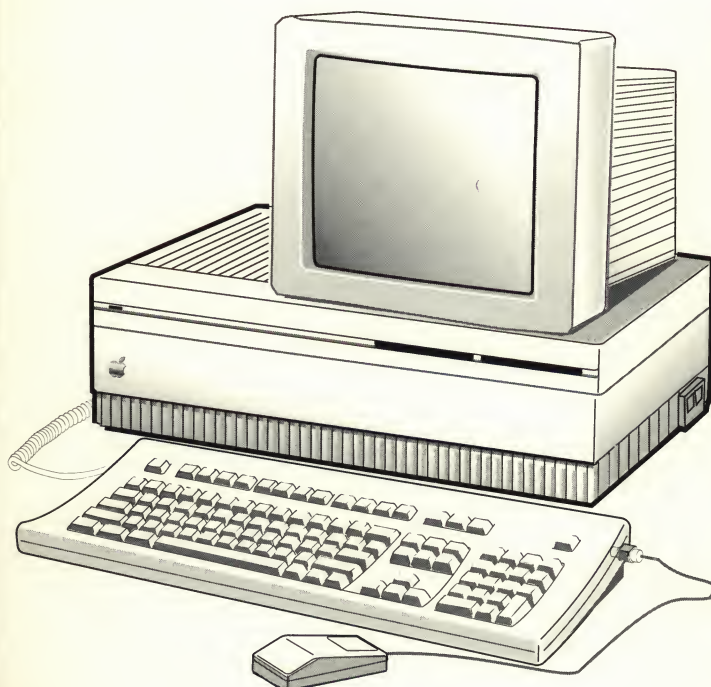
Macintosh II, IIx, and IIfx

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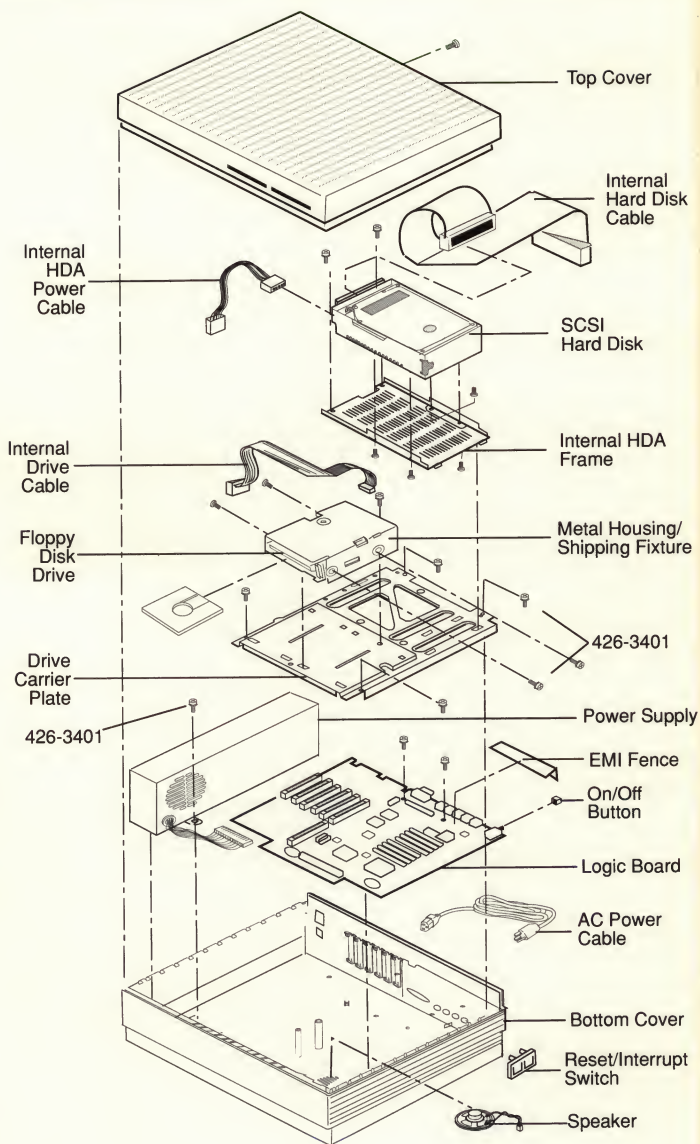
II, IIx, & IIfx





Macintosh II, IIx, and IIcx

Exploded View



Macintosh II, IIx, and IIx

Logic Board Identification

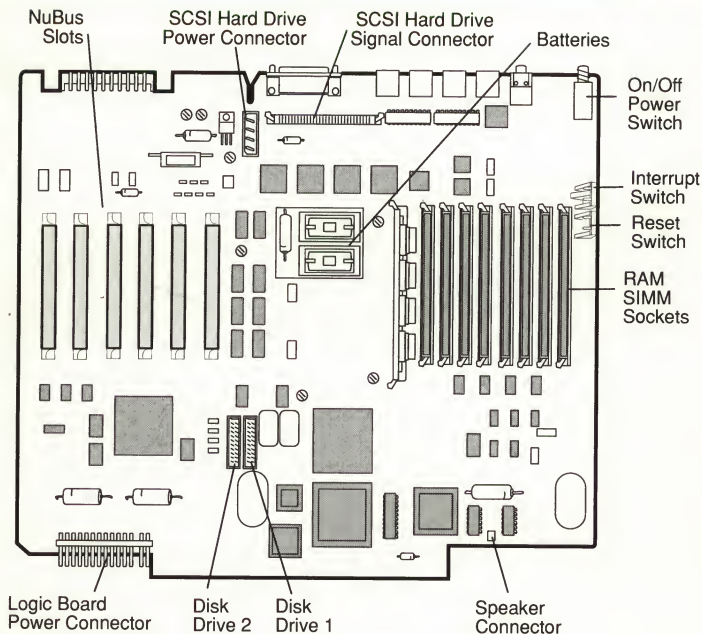


Figure: Macintosh II and IIx Logic Board

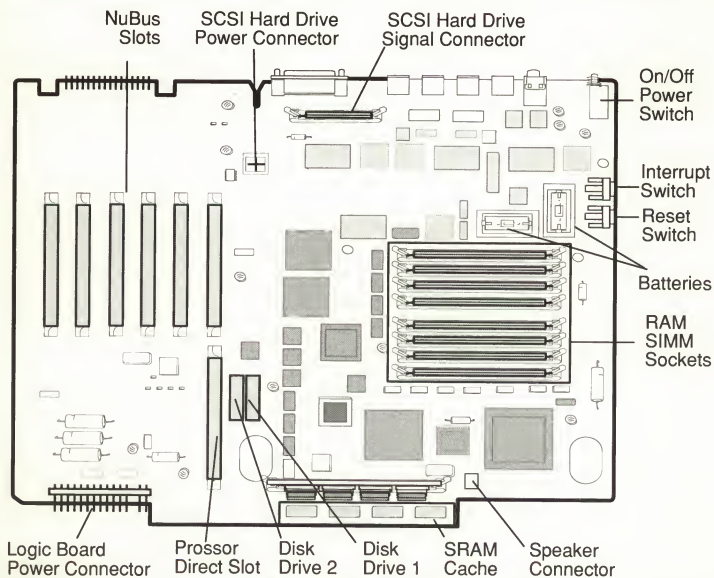


Figure: Macintosh IIx Logic Board



Macintosh II, IIfx, and IIfx Specifications

Macintosh II Specifications	
Microprocessor	MC68020, 32-bit internal architecture 15.6672 MHz clock speed
Coprocessor	MC68881 floating-point unit (FPU)
Memory	1 MB, expandable to 8 MB (120 ns or faster SIMMs) 256K ROM standard Optional 68851 paged memory management unit (PMMU)
Monitors	Apple High-Resolution Monochrome AppleColor™ High-Resolution RGB Apple Macintosh Portrait Display Apple Two-Page Monochrome
Interfaces	Two RS-232/RS-422 ports SCSI interface (50-pin internal connector and DB-25 external connector) Two Apple Desktop Bus (ADB) ports Six NuBus™ internal slots supporting full 32-bit address and data buses One stereo sound port
Internal Storage	Built-in 3.5-inch, 800K disk drive Optional second 3.5-inch, 800K disk drive 1.4 MB, Apple FDHD SuperDrive upgrade Optional internal Hard Disk 20SC, 40SC, 80SC, 160SC
Sound	Apple custom digital sound chip (ASC), including four-voice wave-table synthesis, stereo sampling generator
Electrical	Line voltage: 90 to 140 volts; 170 to 270 volts, automatically configured Frequency: 48 to 62 Hz Maximum power: 220 watts, not including monitor power

Macintosh II, IIx, and IIx

Specifications



Macintosh IIx Specifications

Microprocessor	MC68030, 32-bit internal architecture 15.6672 MHz clock speed 256 byte instruction and data caches Built-in paged memory management unit (PMMU)
Coprocessor	MC68882 floating-point unit (FPU) 15.6672 MHz clock speed
Memory	1 MB, expandable to 8 MB (100 ns or faster SIMMs) 256K ROM standard
Monitors	Apple High-Resolution Monochrome AppleColor High-Resolution RGB Apple Macintosh Portrait Display Apple Two-Page Monochrome
Interfaces	Two RS-232/RS-422 serial ports SCSI interface (50-pin internal connector and DB-25 external connector) Two Apple Desktop Bus (ADB) ports Six NuBus internal slots supporting full 32-bit address and data buses One stereo sound port
Internal Storage	Built-in 1.4 MB, FDHD SuperDrive Optional second FDHD SuperDrive Optional internal Hard Disk 40SC, 80SC, 160SC
Sound	Apple custom digital sound chip (ASC) provides 8-bit stereo sampling at 44.1 KHz and includes four-voice wave-table synthesis
Electrical	Line voltage: 100-240 VAC, automatically configured Frequency: 48 to 62 Hz Max power: 220 watts, not including monitor power



Macintosh II, IIx, and IIfx Specifications

Macintosh IIfx Specifications	
Microprocessor	MC68030, 32-bit internal architecture 40 MHz clock speed Built-in paged memory management unit (PMMU) Two 256 byte instruction and data caches
Coprocessor	MC68882 floating-point unit (FPU) 40 MHz clock speed
Static RAM Cache	Built-in zero-wait-state 32K static RAM cache memory architecture
Memory	4 MB of RAM, expandable to 8 MB 80 ns, fast-page mode, 64-pin SIMMs
Parity Support	Installation of optional parity generating chip and parity DRAM (9-chip, 60-ns SIMM) provides parity error detection
Memory Subsystem	Supports overlapping reads from cache/ROM and writes to DRAM
Input/Output Processor Chips	SWIM chip manages the floppy disk drive(s) SCC chip manages the Apple Desktop Bus and serial ports
SCSI/DMA Controller	Standard cell implementation of 53C80 SCSI chip and DMA control logic (the SCSI/DMA chip manages the SCSI bus)
Interfaces	Two RS-232/RS-422 serial ports SCSI interface with direct memory access for faster transfers and compatibility with faster peripherals Processor direct slot (PDS) provides high-speed, 32-bit access to the system bus Six NuBus internal slots supporting full 32-bit address and data buses Two Apple Desktop Bus (ADB) ports Stereo sound jack
Internal Storage	Two 1.4 MB, FDHD SuperDrives Internal Hard Disk 40SC, 80SC, 160SC
Sound	Apple custom digital sound chip (ASC)
Electrical	Line voltage: 100 to 240 VAC Frequency: 48 to 62 Hz Maximum power: 230 watts, not including monitor power

Macintosh II, IIx, and IIfx

Parts List



800K Mechanism, Apple 3.5 Drive	661-0345
1.4 MB Mechanism, Apple FDHD SuperDrive	661-0474
800K/1.4 MB Drive Parts	
Cable, 3.5 Internal Drive (red or yellow stripe)	590-0188
Internal Drive Shield, 800K (for transporting)	805-0217
Metal Housing/Shipping Fixture (for transporting)	805-5050
Packing Disk, 2-Sided (for transporting 800K Mechanisms)	003-0003
Screw, M 3 x 6, with two washers	462-3401
Bottom Cover Assembly, Macintosh II	630-5227
Bottom Cover Assembly, Macintosh IIx	630-5494
Bottom Cover Assembly, Macintosh IIfx	630-5806
Reset/Interrupt Switch	815-6024
Speaker	630-5222
Cable, Power AC, smoke	590-0380
Drive Carrier	805-5062
Extended Keyboard	661-0384
Extended Keyboard, French	F661-0384
Extended Keyboard, French Canadian	C661-0384
Extended Keyboard, German	D661-0384
Extended Keyboard, Italian	T661-0384
Extended Keyboard, Spanish	E661-0384
Extended Keyboard Parts	
Alps Locking Keyswitch	970-1263
Bottom Case	815-1019
Key Cap Set	658-7010
Keyboard Cable, 1 meter	590-0361
Keyswitch Set (of 10), ADB Keyboard	076-0209
Top Case	815-1018
HDA, 20 MB, Internal 3.5 SCSI	661-0373
HDA, 20 MB, Internal 3.5 SCSI, Rev. B	661-0612
HDA, 40 MB, Internal 3.5 SCSI	661-0464
HDA, 80 MB, Internal 3.5 SCSI	661-0600
HDA, 80 MB, Int. 3.5 SCSI with A/UX® v.1.1 (replaced by 661-0613)	661-0561
HDA, 80 MB, Internal 3.5 SCSI with A/UX, v.2.0	661-0613
HDA, 40 MB, Internal 5.25 SCSI	661-0391
HDA, 80 MB, Internal 5.25 SCSI	661-0411
HDA, 80 MB, Internal 5.25 SCSI with Apple A/UX, v.1.0	661-0457
HDA, 160 MB, Internal 5.25 SCSI	661-0601
HDA Parts	
Cable, Internal Hard Disk	590-0566
Cable, Internal Hard Disk Power, Macintosh II/IIx	590-0364
Cable, Internal Hard Disk Power (2 x 2 pin), Macintosh IIfx	590-0512
Frame, HDA, Internal, 3.5	805-5066
Frame, HDA, Internal, 5.25	805-5051
Screws, M 3.5 x .6 x 8, PNCRS Rec	462-4100
ISO Keyboard, French	F661-0454
ISO Keyboard, German	D661-0454
ISO Keyboard, Italian	T661-0454
Keyboard, Regular Apple	661-0383
Keyboard, French Canadian	C661-0383
Keyboard, Spanish	E661-0383
Keyboard Parts	
Alps Locking Keyswitch	970-1263



Macintosh II, IIx, and IIx

Parts List

Bottom Case	815-1017
Key Cap Set	658-7011
Keyboard Cable, 1 meter	590-0361
Keyboard Cable, 2 meter	590-0152
Keyswitch Set (of 10), ADB Keyboard	076-0209
Top Case	815-1016
Logic Board, Macintosh II (w/o RAM; replaces 661-0374)	661-0528
Battery Holder Board	600-0530
IC, IWM	344S0043
IC, SWIM	344S0062
IC, HMMU	343-0002
IC, PMMU	630-8221
IC, ROM, 512K, Low	342-0642*/342-0108
IC, ROM, 512K, Med Low	342-0641*/342-0107
IC, ROM, 512K, Med Hi	342-0640*/342-0106
IC, ROM, 512K, Hi	342-0639*/342-0105
SIMM, 256K, 120 ns	661-0402
SIMM, DIP, 256K, 120 ns	661-0494
SIMM, 1 MB, 120 ns	661-0403
SIMM, DIP, 1 MB, 120 ns	661-0410
Logic Board, Macintosh IIx (w/o RAM; replaces 661-0463)	661-0529
Battery Holder Board	600-0530
SIMM, 256K, 120 ns	661-0402
SIMM, DIP, 256K, 120 ns	661-0494
SIMM, 1 MB, 120 ns	661-0403
SIMM, DIP, 1 MB, 120 ns	661-0410
Logic Board, Macintosh IIx (w/o RAM)	661-0522
Battery Holder Cover	520-0344
Internal SCSI Termination Block	590-4515
Internal SCSI Filter	590-4516
SIMM, 1 MB, SOJ, 80 ns, 64 pin	661-0548
Logic Board, Parity, Macintosh IIx (w/o RAM)	661-0592
Battery Holder Cover	520-0344
SIMM, 1 MB, SOJ, 60 ns, 64 pin, Parity	661-0549
Logic Board Parts	
EMI Fence	805-5070
Lithium Battery (w/o leads; replaces 742-0009)	742-0011
On/Off Button	815-6237
Screws (logic board mounting)	462-4100
Mouse, Apple Desktop Bus	661-0338
Mouse Ball (25.4 mm dia)	699-8001
Mouse Ball (21.9 mm dia)	699-8038
Retainer, ADB Mouse (38 mm dia)	076-0231
Retainer, ADB Mouse (34 mm dia)	815-0816
Mouse, ADB (replaces 661-0338)	661-0479
Mouse Ball (for 661-0479)	815-1135
Retainer, ADB Mouse (for 661-0479)	815-1136
Power Supply, Macintosh II/IIx	661-0375
Power Supply, Macintosh IIx	661-0542
Top Cover and Latch Assembly	630-5229

*Included in the 1.4 FDHD SuperDrive Mechanism Upgrade

Macintosh II, IIx, and IIcx

Symptom/Cure Chart



System Problems

Solutions

Does not power on, screen is black, fan is not running, and LED is not lit

1. Check cables.
2. Plug monitor directly into wall socket, and verify that monitor has power.
3. Replace power cord.
4. Check batteries.
5. Replace power supply.
6. Replace logic board only.

Clicking, chirping, or thumping sound

1. Replace power supply.
2. Replace logic board only.

System shuts down intermittently

1. Check that air vents on sides and top of main unit are clear. Thermal protection circuitry may shut system down. After 30 to 40 minutes, system should be OK.
2. Replace power cord.
3. Check batteries.
4. Replace power supply.
5. Replace logic board only.

System intermittently crashes or locks up

1. Make sure correct version of system software is being used.
2. Make sure all software is known-good.
3. Replace SIMMs.
4. Replace logic board.
5. Replace power supply.

Screen is black, fan is not running, and LED is not lit

1. Plug monitor directly into wall socket, and verify that monitor has power.
2. Check batteries.
3. Replace power supply.
4. Replace logic board only.

Video Problems

Solutions

Screen is black, audio and drive operate, fan is running, and LED is lit

1. Adjust brightness on monitor.
2. Replace monitor.
3. Replace video cable.
4. Move video card to different slot.
5. Replace video card.
6. Replace SIMMs.
7. Replace logic board.
8. Replace power supply.

Partial or whole screen is bright and audio is present, but no video information is visible

1. Replace monitor.
2. Replace video cable.
3. Move video card to different slot.
4. Replace video card.
5. Replace logic board only.



Macintosh II, IIx, and IIcx

Symptom/Cure Chart

Video Problems (continued)

Solutions

Screen is black, audio and drive do not operate, but fan is running and LED is lit

1. Replace video cable.
2. Move video card to different slot.
3. Replace video card.
4. Replace SIMMs.
5. Replace logic board.
6. Replace power supply.
7. Replace monitor.

Screen is completely dark, fan is not running, and LED is not lit

1. Plug monitor directly into wall socket and verify that monitor has power.
2. Check batteries.
3. Replace power supply.
4. Replace logic board only.

Disk Drive Problems

Solutions

Internal disk drive runs continuously

1. Replace bad disk.
2. Replace internal disk drive cable.
3. Replace internal disk drive.
4. Replace logic board only.

Audio and video are present, but one internal drive does not operate

1. Replace bad disk.
2. Verify that all external SCSI devices are disconnected.
3. Replace internal disk drive cable.
4. Replace internal disk drive.
5. Replace logic board only.
6. Replace power supply.

Audio and video are present, but neither internal drive operates

1. Replace bad disk.
2. Verify that all external SCSI devices are disconnected.
3. Replace power supply.
4. Replace logic board only.

Disk ejects; icon with blinking "X" displays

1. Replace disk with known-good system disk.
2. Replace internal disk drive cable.
3. Replace internal disk drive.
4. Replace logic board only.

Will not eject disk

1. Switch power off and hold mouse button down while switching power back on.
2. Eject disk manually by pushing opened paper clip into hole beside drive slot.
3. Replace internal disk drive.

MS-DOS drive does not recognize disk formatted on 1.4 MB FDHD SuperDrive

- Reformat disk using MS-DOS™ drive.

Macintosh II, IIx, and IIfx

Symptom/Cure Chart



Attempts to eject disk but doesn't

1. Reinsert disk.
2. Reseat top cover so drive slots line up correctly.
3. Try ejecting disk manually by pushing opened paper clip into hole beside drive slot.
4. Replace internal disk drive.

SCSI Drive Problems

Solutions

Internal hard disk will not operate, LED does not light, drive does not spin-up

1. Replace SCSI signal cable.
2. Replace SCSI power cable.
3. Replace hard disk.
4. Replace logic board only.

Drive does not appear on desktop

- If Macintosh IIfx, there may be SCSI termination problem. **Refer to Macintosh IIfx—SCSI Termination** to verify that computer is properly terminated.

Works with internal or external SCSI device but will not work with both

1. Check SCSI device switch setting on external device. Make sure setting isn't 0 (internal hard drive address) or 7 (CPU address).
2. If Macintosh IIfx, there may be SCSI termination problem. **Refer to Macintosh IIfx—SCSI Termination** to verify that computer is properly terminated.
3. Replace SCSI terminator on external device.
4. Verify that terminator is installed on internal SCSI drive.
5. Refer to *SCSI Hard Disk Drive Technical Procedures* for troubleshooting external drive.

Peripheral Problems

Solutions

Cursor does not move

1. Check mouse connection.
2. Clean mouse, if necessary.
3. If mouse was connected to keyboard, connect it to rear ADB port. If mouse works, replace keyboard.
4. If mouse does not work in any ADB port, replace mouse.
5. Replace logic board only.

Cursor moves but clicking mouse button has no effect

1. Replace mouse.
2. Replace logic board only.

No response to any key on keyboard

1. Check keyboard connection to ADB port.
2. Replace keyboard cable.
3. Replace keyboard.
4. Replace logic board only.



Macintosh II, IIx, and IIcx

Symptom/Cure Chart

Peripheral Problems (continued)

Solutions

Cannot double-click to open application, disk, or server

1. Remove any multiple system files on hard disk.
2. Clear parameter RAM. Hold down **<Shift>** **<Option>** **<Command>** keys and select Control Panel from Apple pull-down menu. Reset mouse controls.
3. If mouse was connected to keyboard, connect it to rear ADB port. If mouse works, replace keyboard.
4. If mouse does not work in any ADB port, replace mouse.
5. Replace logic board only.

Known-good ImageWriter or ImageWriter II will not print

1. Make sure correct version of system software is being used.
2. Make sure that Chooser and Control Panel are set correctly.
3. Replace printer interface cable.
4. Replace logic board only.

Known-good LaserWriter will not print

1. Make sure correct version of system software is being used.
2. Make sure that Chooser and Control Panel are set correctly.
3. Refer to Networks tab in *Apple Service Technical Procedures*.

Miscellaneous Problems

Solutions

No sound from speaker

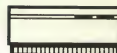
1. Verify that volume setting in Control Panel is set to 1 or above.
2. Replace speaker.
3. Replace logic board only.

HMMU socket does not allow PMMU installation

- Replace logic board. Verify that socket is 13 x 13 grid array package and that it contains 132 gold contacts inside socket. (Sockets containing 70 pins do not support PMMU.)

Macintosh II, IIx, and IIcx

Memory Upgrades



Macintosh II and IIx Memory Upgrades

The Macintosh II and IIx require 120-ns (or faster) SIMMs. The 150-ns SIMMs will cause serious timing problems. All SIMMs in each bank must be the same size. Mitsubishi 1 MB SIMMs for the Macintosh IIx, which are labeled "For 030 Systems Only," should be used only in systems with 68030 microprocessors.

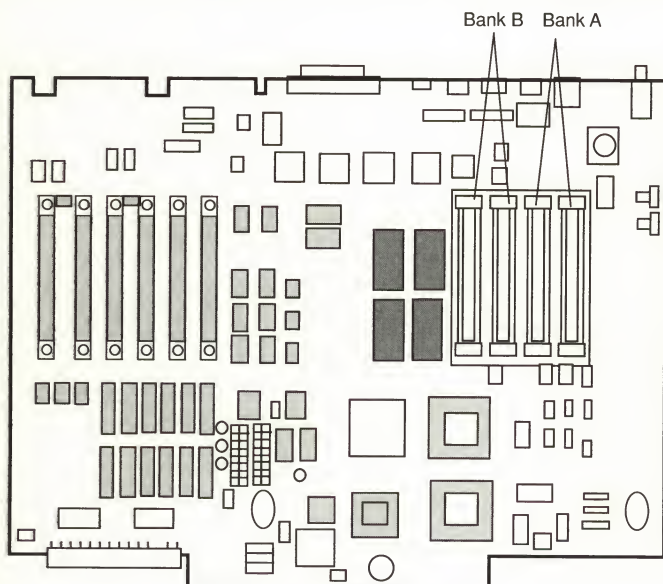


Figure: Macintosh II and IIx Logic Board

Size	Bank A	Bank B
1 MB	4—256K SIMMs	Empty
2 MB	4—256K SIMMs	4—256K SIMMs
4 MB	4—1 MB SIMMs	Empty
5 MB	4—1 MB SIMMs	4—256K SIMMs
8 MB	4—1 MB SIMMs	4—1 MB SIMMs



Macintosh II, IIx, and IIx

Macintosh II PMMU Upgrade

Macintosh IIx Memory Upgrade

The Macintosh IIx requires 80-ns (or faster) SIMMs in systems without the parity checking option, 60-ns (or faster) SIMMs in systems with parity checking. LaserWriter II SIMMs cannot be used in the Macintosh IIx.

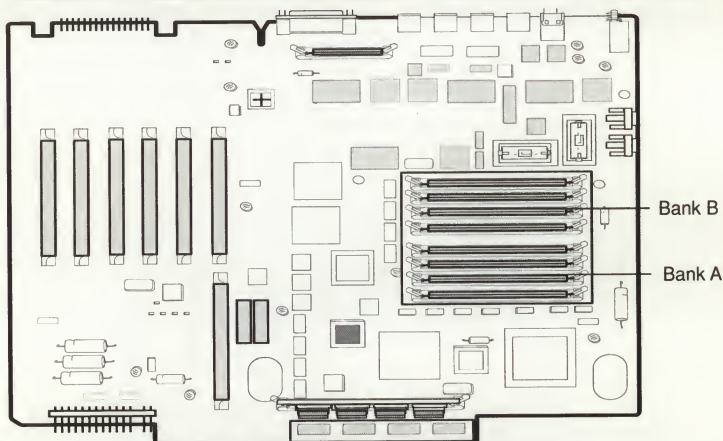


Figure: Macintosh IIx Logic Board

Size	Bank A	Bank B
4 MB	4 — 1 MB SIMMs	Empty
8 MB	4 — 1 MB SIMMs	4 — 1 MB SIMMs

Macintosh II PMMU Upgrade Procedure

1. Remove the Macintosh II top cover and drive mount.
2. Locate the HMMU chip on the Macintosh II logic board.
3. Using a small flat-blade screwdriver, gently pry up the sides of the chip to remove the HMMU from the socket.
4. Position the PMMU so that the line on its surface is pointing toward the speaker at the lower-right corner of the logic board.
5. Line up the pins in the socket and gently press the PMMU into the socket.
6. Replace the Macintosh II drive mount and top cover.

Macintosh II, IIfx, and IIfx

Macintosh II FDHD SuperDrive Upgrade



The system software must be version 6.0.2 or higher to use the 1.4 MB FDHD SuperDrive. If the software is lower than 6.0, the drive will be recognized as an 800K mechanism.

Upgrade Procedure

1. Place the Macintosh II on the grounded workbench pad and put on your grounding wriststrap.
2. Remove the top cover, video card (and any other cards installed), and the drive mount.
3. Using an IC extractor, remove the four ROMs at locations C13, C12, E13, and E12 on the logic board (**see Figure**).
4. Use the following chart to install the four revised 512K ROMs. The notch at the end of each ROM should face the front of the logic board.

ROM	P/N	Location
HI	342-0639	C13
MED HI	342-0640	C12
MED LO	342-0641	E13
LO	342-0642	E12

5. Using the IWM/SWIM extractor (**see Special Tools Index in the General Information section**), remove the IWM chip at location I10 on the logic board.
6. Position the SWIM chip over location I10 so that the beveled edge with the dot is facing the white dot on the logic board beside the socket.
7. Line up the pins in the socket and gently press straight down on the SWIM chip until it is seated in the socket.
8. Install the 1.4 MB FDHD SuperDrive onto the drive mount on drive 1 or drive 2.
9. Replace the drive mount, the video card (and any other cards that you removed), and the top cover.
10. Place the 1.4 MB and 800K labels in the appropriate positions on the front of the Macintosh II.

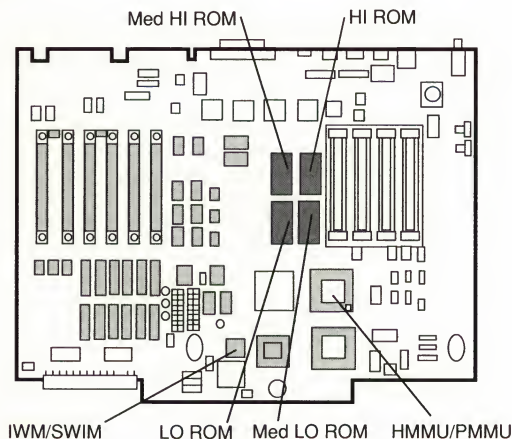


Figure: Macintosh II Logic Board



Macintosh II, IIx, and IIcx

Macintosh IIcx—SCSI Termination

The Macintosh IIcx is able to transfer data to and from SCSI devices much faster than earlier Macintosh computers. This increased data transfer rate has made it necessary to modify the termination characteristics of the SCSI interface. Three new parts are used to implement these SCSI termination changes:

- Apple SCSI Cable Terminator II
- Internal SCSI Termination Block
- Internal SCSI Filter

Apple SCSI Cable Terminator II

SCSI Cable Terminator II must be installed to provide proper termination when one or more external SCSI devices is attached to a Macintosh IIcx. Rules for using and installing Terminator II are the same as those for the original SCSI terminator. To help you tell these devices apart, the plastic on the Terminator II is black, whereas the plastic on the original terminator is blue.



CAUTION: Never connect more than one Cable Terminator II on a SCSI daisy-chain. Connecting more than one terminator can damage the Macintosh IIcx.

Internal SCSI Termination Block

The termination block must be installed to provide internal SCSI termination for systems **without** an internal SCSI hard drive. Apple installs this termination block (and the internal SCSI filter) at the logic board SCSI connector on all Macintosh IIcx systems shipped without internal SCSI drives (**see Figure**). The termination block must be removed when an internal SCSI drive is added to the system.

Internal SCSI Filter

The SCSI filter must be installed to provide the proper termination capacitance for third-party drives and for Apple internal drives shipped before 3/19/90. When a SCSI drive is added to a Macintosh IIcx that had no SCSI drives installed, **the SCSI filter must be removed from the Macintosh IIcx logic board and connected to the drive.**

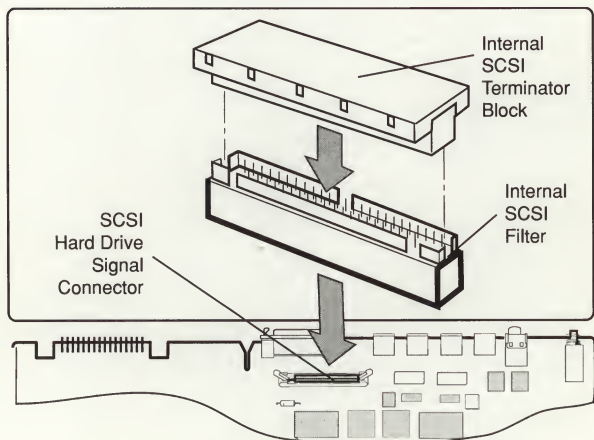


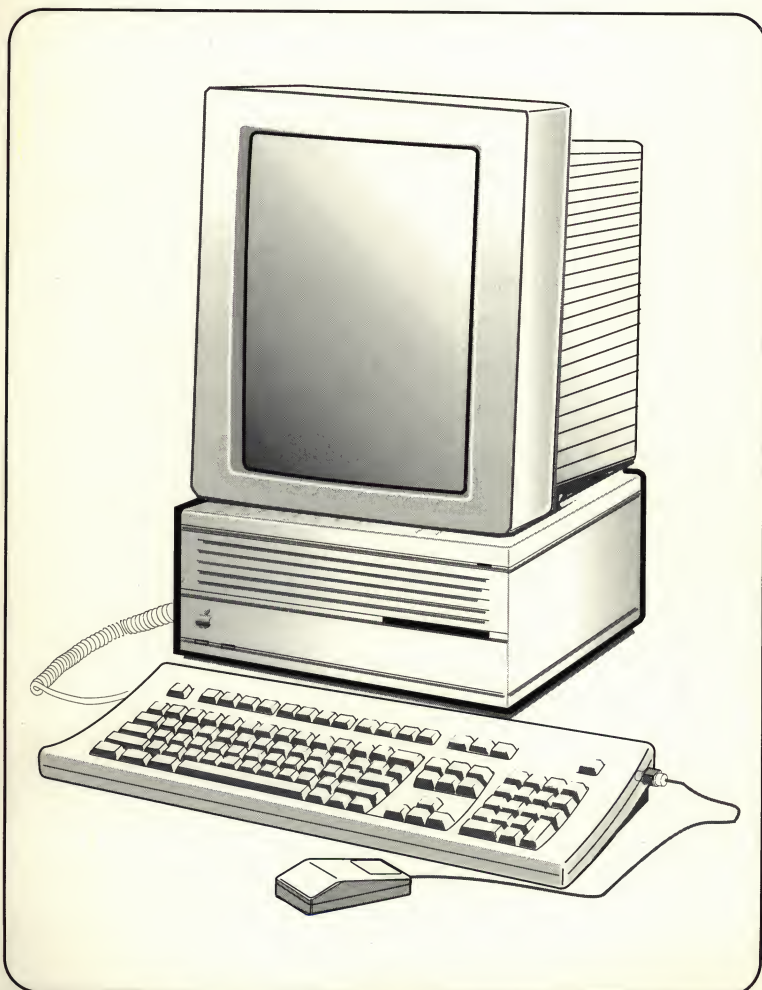
Figure: Macintosh IIcx Without Internal SCSI Drive



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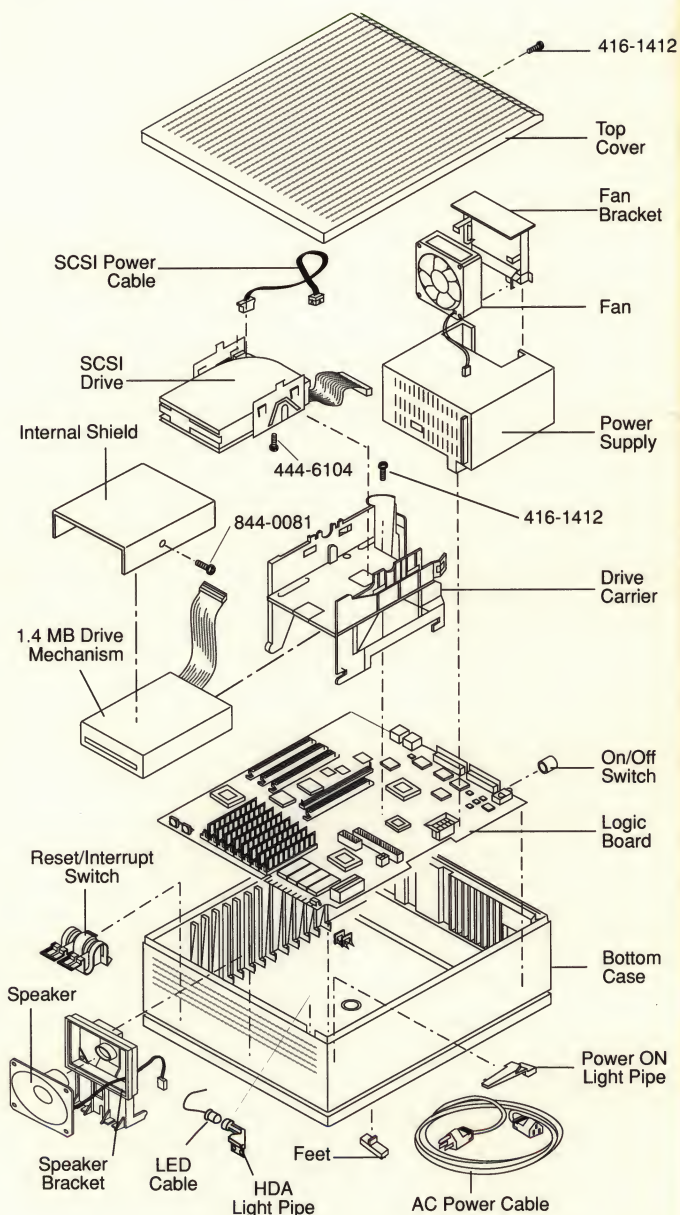
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Macintosh Ilcx and Ilci

Exploded View



Macintosh Ilcx and Ili

Logic Board Identification

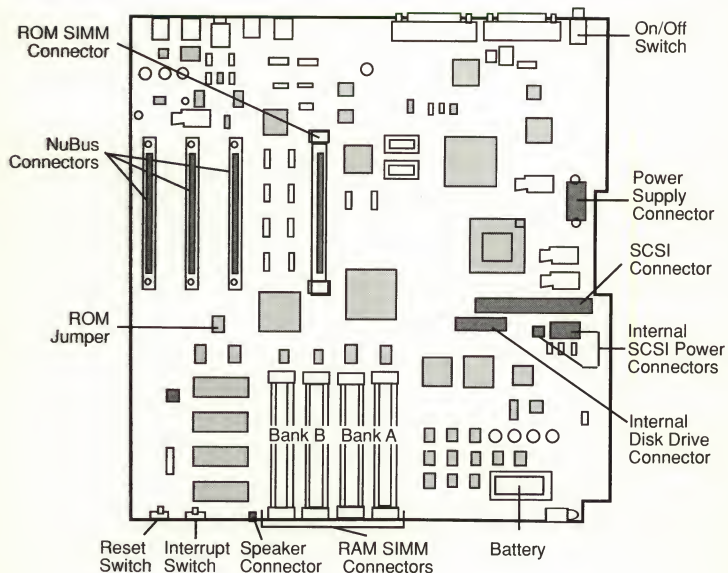
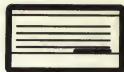


Figure: Macintosh Ilcx Logic Board

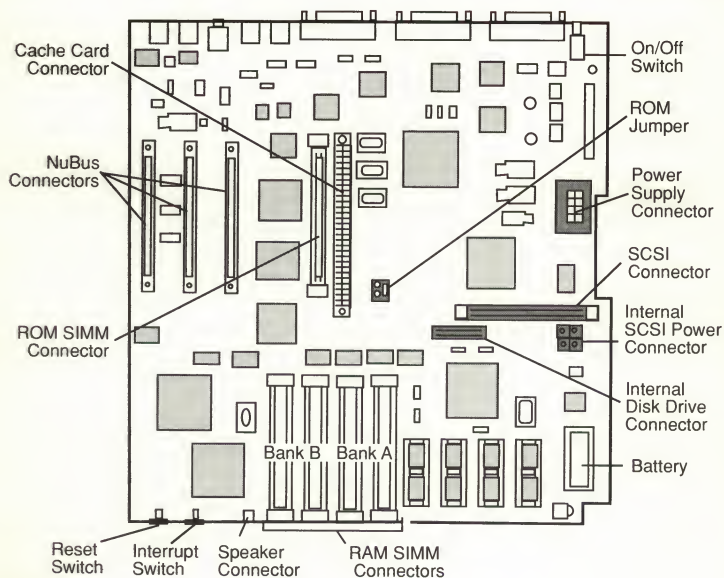
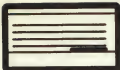


Figure: Macintosh Ili Logic Board



Macintosh IIfx and IIfx Specifications

Macintosh IIfx Specifications	
Microprocessor	MC68030, 32-bit internal architecture 15.6672 MHz clock speed Built-in paged memory management unit (PMMU) 256 byte instruction and data caches
Coprocessor	MC68882 floating-point unit (FPU)
Memory	1 MB expandable to 8 MB (120 ns or faster SIMMs) 256K ROM standard
Monitors	Apple High-Resolution Monochrome AppleColor High-Resolution RGB Apple Macintosh Portrait Display Apple Two-Page Monochrome
Interfaces	Two RS-232/RS-422 ports SCSI interface (50-pin internal connector and DB-25 external connector) Two Apple Desktop Bus (ADB) ports Three NuBus internal slots supporting full 32-bit address and data buses Stereo sound port One DB-19 serial (disk drive) port
Internal Storage	Built-in 1.4 MB, FDHD SuperDrive Optional internal Hard Disk 40SC, 80SC
Sound	Apple custom digital sound chip (ASC), including four-voice wave-table synthesis and stereo sampling generator
Electrical	Line voltage: 90 to 140 volts; 170 to 270 volts, automatically configured Frequency: 50 to 60 Hz Maximum power: 90 watts, not including monitor power

Macintosh Ilcx and Ilci

Specifications



Macintosh Ilci Specifications

Microprocessor	MC68030, 32-bit internal architecture 25 MHz clock speed Burst mode RAM access 256 byte instruction and data caches Built-in paged memory management unit (PMMU)
Coprocessor	MC68882 floating-point unit (FPU) 15.6672 MHz clock speed
Cache Connector	120-pin memory cache connector (for connection of optional high-speed memory cache card)
Memory	1 MB expandable to 8 MB (80 ns or faster SIMMs) 512K ROM standard
Parity Support	Purchase of optional parity board with parity generating chip and parity RAM converts the system to a parity system
Built-in Video Support	Apple High-Resolution Monochrome AppleColor High-Resolution RGB Apple Macintosh Portrait Display
Interfaces	Two RS-232/RS-422 ports SCSI interface (50-pin internal connector and DB-25 external connector) One DB-19 serial (disk drive) port Two Apple Desktop Bus (ADB) ports Three NuBus internal slots supporting full 32-bit address and data buses One DB-15 video port for built-in video Stereo sound port
Internal Storage	Built-in 1.4 MB, FDHD SuperDrive Optional internal Hard Disk 40SC, 80SC
Sound	Apple custom digital sound chip (ASC), including four-voice wave-table synthesis and stereo sampling generator
Electrical	Line voltage: 100 to 240 volts AC, automatically configured Frequency: 50 to 60 Hz Maximum power: 90 watts, not including monitor



Macintosh IIcx and IIci

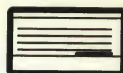
Parts List

Macintosh IIcx & Macintosh IIci

1.4 MB Mechanism, Apple FDHD SuperDrive	661-0474
Cable, Internal 1.4 MB Mechanism	590-0607
Screw, Socket, Phillips (1.4 MB Mechanism)	844-0018
Shield, Internal 1.4 MB Mechanism	805-0961
Bottom Case	630-5502
Cable, HDA LED (amber)	590-0506
Light Pipe, Power On	815-6032
Light Pipe, HDA	815-6036
Rubber Feet	865-0026
Cable, AC Power (smoke)	590-0380
Drive Carrier	815-6030
Extended Keyboard, Apple	661-0384
Extended Keyboard, French Canadian	C661-0384
Extended Keyboard, French	F661-0384
Extended Keyboard, German	D661-0384
Extended Keyboard, Spanish	E661-0384
Extended Keyboard, Italian	T661-0384
Extended Keyboard Parts	
Alps Locking Keyswitch	970-1263
Bottom Case	815-1019
Key Cap Set	658-7010
Keyboard Cable, 1 meter	590-0361
Keyswitch Set (of 10), ADB Keyboard	076-0209
Top Case	815-1018
HDA, 20 MB, Internal 3.5 SCSI	661-0373
HDA, 40 MB, Internal 3.5 SCSI	661-0464
HDA, 80 MB, Internal 3.5 SCSI	661-0600
HDA, 80 MB, Int. 3.5 SCSI with A/UX, v.1.1 (replaced by 661-0613)	661-0561
HDA, 80 MB, Internal 3.5 SCSI with A/UX, v.2.0	661-0613
Bracket, HDA, Mounting	805-5078
Cable, Internal HDA Power (Mac IIcx only)	590-0505
Cable, Internal HDA Power (2 x 2 Pin; Mac IIci only)	590-0512
Cable, Internal HDA	590-0609
Screw, 6-32 x .250 (HDA to HDA Bracket)	444-6104
ISO Keyboard, French	F661-0454
ISO Keyboard, German	D661-0454
ISO Keyboard, Italian	T661-0454
Keyboard, Regular Apple	661-0383
Keyboard, French Canadian	C661-0383
Keyboard, Spanish	E661-0383
Keyboard Parts	
Alps Locking Keyswitch	970-1263
Bottom Case	815-1017
Key Cap Set	658-7011
Keyboard Cable, 1 meter	590-0361
Keyboard Cable, 2 meter	590-0152
Keyswitch Set (of 10), ADB Keyboard	076-0209
Top Case	815-1016

Macintosh Ilcx and Ilci

Parts List



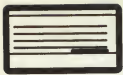
Mouse, Apple Desktop Bus	661-0338
Mouse Ball (25.4 mm dia)	699-8001
Mouse Ball (21.9 mm dia)	699-8038
Retainer, ADB Mouse (38 mm dia)	076-0231
Retainer, ADB Mouse (34 mm dia)	815-0816
Mouse, ADB (replacing part 661-0338)	661-0479
Mouse Ball (for part 661-0479)	815-1135
Retainer, ADB Mouse (for part 661-0479)	815-1136
Power Supply with Fan	661-0467
Bracket, Power Supply Fan	815-5071
Power Supply Fan	982-0023
Reset/Interrupt Switch	815-6034
Speaker	590-5503
Speaker Bracket	815-6031
Top Cover	810-6028
Screw, M 3.5 x .6 x 8 (Top Cover; HDA Bracket/Bottom Case)	416-1412

Macintosh Ilcx

Logic Board (w/o RAM; replaces 661-0459)	661-0537
Battery Holder Cover	520-0344
Lithium Battery (without Leads)	742-0011
On-Off Button	815-6033
SIMM, 256K, 120 ns	661-0402
SIMM, DIP, 256K, 120 ns	661-0494
SIMM, 1 MB, 120 ns	661-0403
SIMM, DIP, 1 MB, 120 ns	661-0410

Macintosh Ilci

Logic Board	661-0532
Battery Holder Cover	520-0344
Lithium Battery	742-0011
On-Off Button	815-6033
SIMM, 256K x 4, 80 ns	661-0519
SIMM, 1 MB, 80 ns	661-0520
Logic Board, Parity	661-0583
Battery Holder Cover	520-0344
Lithium Battery	742-0011
SIMM, 1 MB x 9, 80 ns, Parity	661-0546



Macintosh Ilcx and Ilci

Symptom/Cure Chart

System Problems

Solutions

Does not power on—screen is black, fan is not running, and LED is not lit

1. Check cables.
2. Plug monitor directly into wall socket, and verify that monitor has power.
3. Replace power cord.
4. Check batteries. **Refer to Troubleshooting—Startup Problems, Flowchart 5, in General Information.**
5. Replace power supply.
6. Replace logic board.

Clicking, chirping, or thumping sound

1. Replace power supply.
2. Replace logic board only.

System shuts down intermittently

1. Make sure air vents on back side and top of main unit are kept clear. Thermal protection circuitry may shut down system. After 30 to 40 minutes, system should be OK.
2. Replace power cable.
3. Replace power supply.
4. Replace logic board only.

System intermittently crashes or locks up

1. Make sure correct version of system software is being used.
2. Make sure software is known-good.
3. Replace logic board only.
4. Replace SIMMs.
5. Replace power supply.

System seems to boot, then message "Finder is old version" displays

1. Clear parameter RAM. Hold down <Command> <Option> <P> <R> keys and reboot system. You will hear normal startup chords and about two seconds later you will hear another chord. This means parameter RAM has been cleared.
2. Replace logic board only.

Video Problems

Solutions

Screen is dark, audio and drive operate, fan is running, and LED is lit

1. Adjust brightness on monitor.
2. Replace monitor.
3. Replace video cable.
4. Move video card (if installed) to a different slot.
5. Replace video card (if installed).
6. Make sure ROM jumper is on logic board.
7. Replace SIMMs.
8. Replace logic board.
9. Replace power supply.

Macintosh IIcx and IIci

Symptom/Cure Chart



Screen is dark,
no audio, but fan is
running and LED is lit

1. Replace video cable.
2. Replace monitor.
3. Move video card (if installed) to a different slot.
4. Replace video card (if installed).
5. Make sure ROM jumper is on logic board.
6. Remove any NuBus cards, if installed.
7. Remove any external peripheral, if installed.
8. Replace SIMMs.
9. Replace logic board.
10. Replace power supply.

Partial or whole
screen is bright and
audio is present, but
no video information
is visible

1. Replace monitor.
2. Replace video cable.
3. Move video card (if installed) to a different slot.
4. Replace video card (if installed).
5. Make sure ROM jumper is on logic board.
6. Replace logic board only.

Screen is completely
dark, fan is not
running and LED
is not lit

1. Plug monitor directly into wall socket, and verify that monitor has power.
2. Remove any installed NuBus cards.
3. Remove any external peripherals, if attached.
4. Replace power supply.
5. Replace logic board only.

Black and white
video only

- Change monitor CDEV in Control Panel for additional shades of gray.

Note: Systems with 1 MB of memory default to black and white video. Allocating additional memory to video on 1 MB systems can be done, but this leaves little free RAM for other applications.

Drive Problems

Solutions

Audio and video are
present, but
internal drive does
not operate

1. Replace bad disk.
2. Verify that all external SCSI devices are disconnected.
3. Replace internal disk drive cable.
4. Replace internal disk drive.
5. Replace logic board only.
6. Replace power supply.

Disk ejects; display
shows icon with
blinking "X"

1. Replace disk with known-good system disk.
2. Replace internal disk drive cable.
3. Replace internal disk drive.
4. Replace logic board only.

Will not eject disk

1. Switch power off and hold mouse button down while switching power back on.
2. Eject disk manually by pushing opened paper clip into hole beside the drive slot.
3. Replace disk drive.



Macintosh Ilcx and Ilci

Symptom/Cure Chart

Drive Problems (continued)

Solutions

System attempts to eject disk but cannot

1. Try pushing disk completely back in.
2. Eject disk manually by pushing opened paper clip into hole beside the drive slot.
3. Replace disk drive.

Internal disk drive runs continuously

1. Replace bad disk.
2. Replace internal disk drive cable.
3. Replace internal disk drive.
4. Replace logic board only.

SCSI Problems

Solutions

Internal hard disk will not operate

1. Replace SCSI cable connector.
2. Replace SCSI power connector.
3. Replace hard disk.
4. Replace logic board only.

Works with internal or external SCSI device but will not work with both

1. Check SCSI device switch setting on external device.
2. Replace terminator on external device.
3. Verify that terminator is installed on internal SCSI drive.
4. Replace SCSI device select cable.

Peripheral Problems

Solutions

Cursor does not move

1. Check mouse connection.
2. If mouse was connected to a keyboard, connect it to a rear ADB port. If mouse works, replace keyboard.
3. If mouse does not work in any ADB port, replace mouse.
4. Replace logic board only.

Cursor moves but clicking the mouse button has no effect

1. Replace mouse.
2. Replace logic board only.

Cannot double-click to open an application, disk, or server

1. Remove any multiple system files on hard disk.
2. Clear parameter RAM. Hold down <Shift> <Option> <Command> keys and select Control Panel from Apple menu. Reset mouse controls.
3. If mouse was connected to keyboard, connect it to rear ADB port. If mouse works, replace keyboard.
4. If mouse does not work in any ADB port, replace mouse.
5. Replace logic board only.

Macintosh Ilcx and Ilci

Symptom/Cure Chart



No response to any key on the keyboard

1. Check keyboard connection to ADB port.
2. Replace keyboard cable.
3. Replace keyboard.
4. Replace logic board only.

Known-good ImageWriter or ImageWriter II will not print

1. Make sure correct version of system software is being used.
2. Make sure that Chooser and Control Panel are set correctly.
3. Replace printer interface cable.
4. Replace logic board only.

Known-good LaserWriter will not print

1. Make sure correct version of system software is being used.
2. Make sure that Chooser and Control Panel are set correctly.
3. Refer to Networks tab in *Apple Service Technical Procedures* for more information.

Miscellaneous Problems

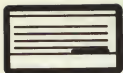
Solutions

No sound from speaker

1. Verify that volume setting in the Control Panel is set to 1 or above.
2. Replace speaker.
3. Replace logic board only.

Clock not running

1. Replace battery.
2. Replace logic board only.



Macintosh Ilcx and Ilci

Macintosh Ilcx Memory Upgrade

The Macintosh Ilcx requires 120-ns (or faster) SIMM modules. The 150-ns SIMMs will cause serious timing problems. All SIMMs in each bank must be the same size.

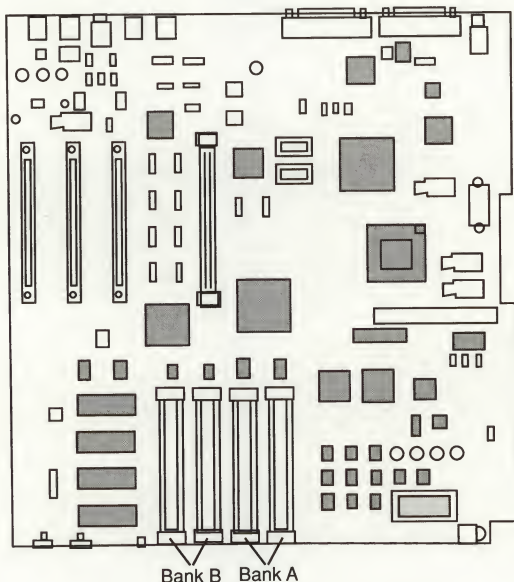


Figure: Macintosh Ilcx Logic Board

Size	Bank A	Bank B
1 MB	4—256K SIMMs	Empty
2 MB	4—256K SIMMs	4—256K SIMMs
4 MB	4—1 MB SIMMs	Empty
5 MB	4—1 MB SIMMs	4—256K SIMMs
8 MB	4—1 MB SIMMs	4—1 MB SIMMs

Macintosh Ilcx and Ilci

Macintosh Ilci Memory Upgrade



The Macintosh Ilci requires 80-ns fast page mode SIMM modules. The 100-, 120-, and 150-ns SIMMs will cause serious timing problems. All SIMMs in each bank must be the same size. SIMMs must be installed in Bank A if built-in video mode is being used. To upgrade a parity system the 80-ns, 1 MB x 9-bit parity SIMMs must be used or the parity function will be disabled.

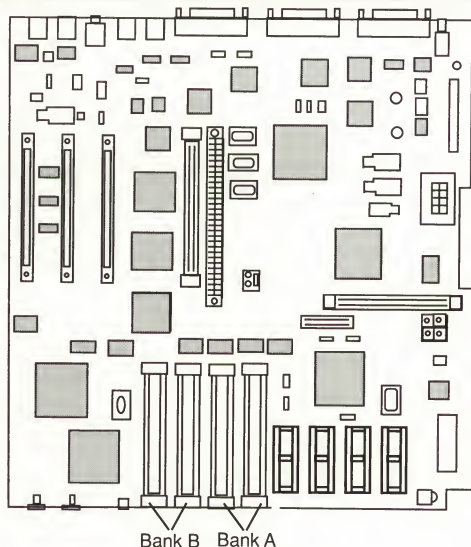
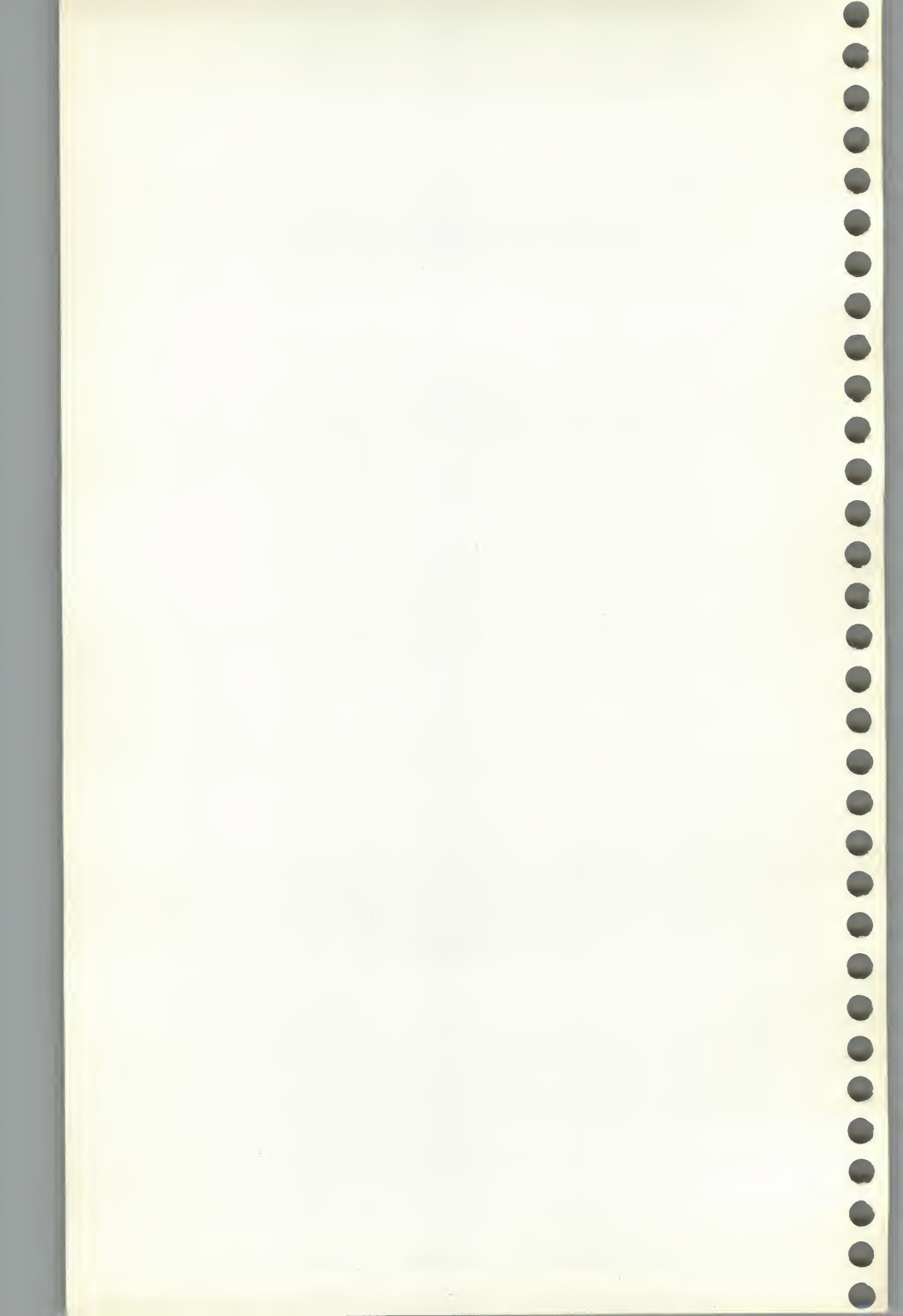


Figure: Macintosh Ilci Logic Board

Size	Bank A	Bank B
1 MB	4—256K SIMMs Empty	Empty 4—256K SIMMs
2 MB	4—256K SIMMs	4—256K SIMMs
4 MB	4—1 MB SIMMs Empty	Empty 4—1 MB SIMMs
5 MB	4—1 MB SIMMs 4—256K SIMMs	4—256K SIMMs 4—1 MB SIMMs
8 MB	4—1 MB SIMMs	4—1 MB SIMMs
4 MB Parity	4—1 MB parity SIMMs Empty	Empty 4—1 MB parity SIMMs
8 MB Parity	4—1 MB parity SIMMs	4—1 MB parity SIMMs



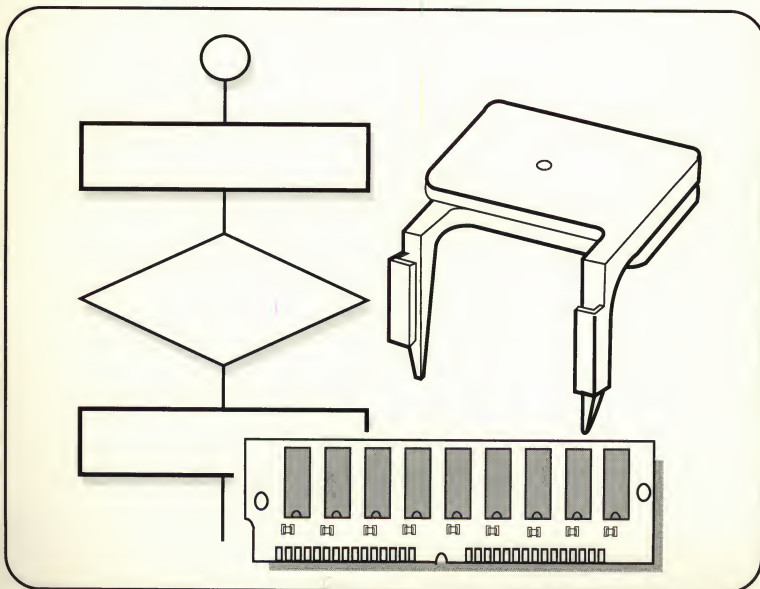


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Note: This General Information section contains repair procedures, troubleshooting flowcharts, compatibility charts, tables of failure codes, and other information that apply to all of the Macintosh computers.





General Information

Disk Drives—Disk Ejection Problems

To avoid disk ejection problems:

- Avoid placing more than two labels on a disk. Make sure another disk is not already in the drive, and press disks gently into the drive.
- During installation, make sure the disk opening of the drive mechanism is centered in the bezel. If the disk opening is not centered, binding or friction may cause disk ejection problems.
- Inspect the internal mounting bracket before installation. A warped or bent mounting bracket will not align properly with the bezel and can cause disk ejection problems.



CAUTION: Pulling a disk forcefully from a drive may damage the drive mechanism.

Removing Disks That Will Not Eject

1. Push the disk back in and try to eject it electronically by:
 - a. Holding down the <Shift> and <Command> keys and pressing **1** (for an internal drive or drive 1) or **2** (for an external drive or drive 2).
 - b. Pulling down the File menu and selecting **Eject**. (Repeat several times before giving up.)
2. If step 1 does not work, insert a straightened paper clip into the pin hole located to the right of the disk insertion slot.
3. If step 2 does not work, remove the disk drive and place the drive and RFI shield assembly upside down on a flat surface.
4. Remove the four screws that hold the drive mechanism to the RFI shield, and remove the drive mechanism.
5. Place the drive mechanism with the printed circuit board face down and the disk opening facing you. Press the eject lever at the right side of the disk drive (**see top figure below**).
6. With the left side of the drive mechanism facing you, locate the small arm with a cylindrical cog at its end (**see bottom figure below**). The cog will be caught in a half-moon depression.
7. Insert a small screwdriver as shown in the figure, and gently move the arm away from the disk until the disk pops forward slightly. Remove the disk from the disk drive.

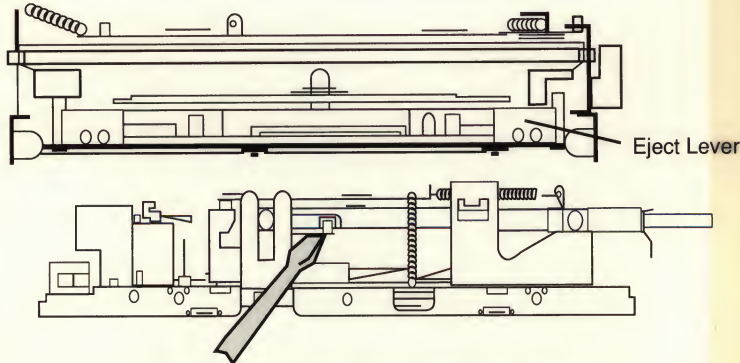


Figure: Removing Stuck Disk From Drive

General Information

Disk Drives—Internal Drive Cables



To identify the correct disk drive cable, refer to the part number stamped on the ribbon cable. Except for the red 400K drive cable (which does not have a stamped-on part number), do not rely upon cable color. Be sure to use only the cables listed in the compatibility table below.

Internal Disk Drive Cable Compatibility

Macintosh Computers	400K Drive 661-76156	800K Drive 661-0305 (MFD-51W or MFD- 51W-10) ¹	800K Drive 661-0345 (MFD-51W-03)	1.4 MB (FDHD) SuperDrive 661-0474
512K ²	590-0167 Red (short)			
512K Enhanced ²	590-0167 Red (short)	590-0167 Red (short)	590-0437 Yellow (short)	
Plus ²		590-0167 Red (short)	590-0437 Yellow (short)	
SE ³			590-0437 (bottom drive) 590-0188 Red or Yellow (long cable; top drive)	590-0437 (bottom) 590-0188 (top)
SE/30			590-0437 (bottom) 590-0188 (top)	590-0437 (bottom) 590-0188 (top)
II ³			590-0188	590-0188
IIx/IIfx			590-0188	590-0188
IIcx/IIci				590-0607
Portable				590-0501

¹ Drive 661-0305 (obsolete) was replaced by drive 661-0345.

² When replacing or upgrading to an 800K drive in the Macintosh 512K, 512K enhanced or Macintosh Plus, be sure to use disk drive cable 590-0437 (yellow). **The red drive cable (590-0167) used with 400K and obsoleted 800K drives (661-0305) is not interchangeable with cable 590-0437.**

³ Using an FDHD in the Macintosh SE and Macintosh II requires upgrading the logic board (refer to the **FDHD upgrade procedures in these computer sections**).



General Information

Disk Drives—Identification

The FDHD SuperDrive is a high-density (1.4 MB), 3.5-inch drive for 030 Macintosh systems and upgraded Macintosh SE and Macintosh II systems (**see FDHD Upgrade in those sections**). The FDHD SuperDrive is compatible with Apple's 400K and 800K data formats and also provides data exchangeability between Apple (GCR data format) and MS-DOS (MFM data format) systems.

Identifying an Internal Disk Drive

To identify an unlabelled internal drive, you can remove the computer's cover and count the number of microswitches on the drive mechanism (**see Figure**). FDHD SuperDrives have three microswitches, 800K drives have two, and 400K drives have one.

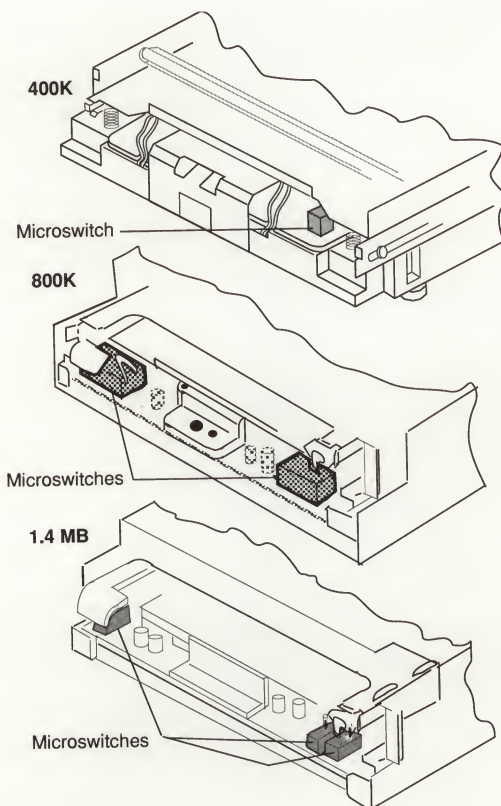


Figure: Macintosh Internal Disk Drives

General Information

Disk Drives—Drive/Media Compatibility



High-Density Media

Special high-density, 3.5-inch disks are required to take full advantage of the increased storage capacity of the FDHD. These disks can be identified by the **HD** on the label, and by their two write-protect windows. Because HD disks are structurally different from other media, media/drive compatibility problems can occur. To avoid such problems, refer to the matrix below.



CAUTION: Apple does not recommend using high-density disks in 400K or 800K disk drives. Data saved to high-density disks using 400K or 800K drives is unreliable and could be lost.

Media and Drive Compatibility Matrix

		Media Formats			
		400K (GCR)	800K (GCR)	720K (MFM)	1.4 MB (MFM)
Single-Sided Disks	400K Drive	Yes	No	No	No
	800K Drive	Yes	NR	No	No
	FDHD Drive	Yes	NR	No	No
Double-Sided Disks	400K Drive	Yes	No	No	No
	800K Drive	Yes	Yes	No	No
	FDHD Drive	Yes	Yes	Yes	No
High-Density Disks	400K Drive	NR	No	No	No
	800K Drive	NR	NR	No	No
	FDHD Drive	No	No	No	Yes

Legend:

Yes—The selected disk and drive can read and write this media format.















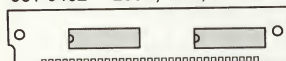






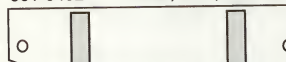






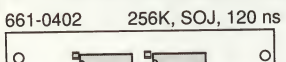













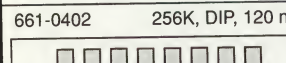


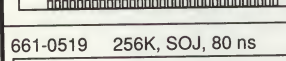







No—The selected disk cannot be used with the selected drive to read or write this media format.

NR—Apple does not recommend formatting the selected disk to this media format with the selected drive.



General Information

SIMM Identification—256K SIMMs

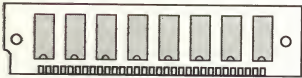







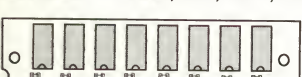

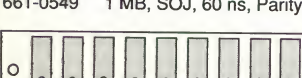

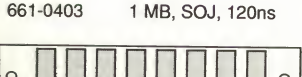

Service Exchange Modules	Macintosh							
	Plus	SE	SE/30	II	IIx	IIfx	IIcx	IIci
661-0402 256K, PLCC, 120 ns 								
661-0402 256K, DIP, 120 ns 								
661-0402 256K, SOJ, 120 ns 								
661-0402 256K, SOJ, 120 ns 								
661-0402 256K, SOJ, 120 ns 								
661-0494 256K, DIP, 120 ns 								
661-0402 256K, DIP, 120 ns 								
661-0519 256K, SOJ, 80 ns 								

- 1 Can be installed in SIMM positions 3 and 4 only because of space constraints.
- 2 Can be installed in SIMM Bank A only because of space constraints.
- 3 Available from finished goods only—you will not receive this SIMM as a service exchange module. Apple ships a compatible service exchange module when receiving a finished-goods SIMM.

General Information

SIMM Identification—1 MB SIMMs



Service Exchange Modules	Macintosh							
	Plus	SE	SE/30	II	IIx	IIfx	IIcx	IIci
661-0403 1 MB, SOJ, 120 ns  	Apple	Apple	Apple	Apple	Apple		Apple	
661-0410 1 MB, DIP, 120 ns  		1	2	Apple	Apple		Apple	
661-0520 1 MB, SOJ, 80 ns  	Apple	Apple	Apple	Apple	Apple		Apple	Apple
661-0546 1 MB, SOJ, 80 ns Parity  	Apple	Apple	Apple	Apple	Apple		Apple	Apple
661-0548 1 MB, SOJ, 80 ns, 64-Pin  						Apple		
661-0549 1 MB, SOJ, 60 ns, Parity, 64-Pin  						Apple		
661-0403 1 MB, SOJ, 120ns  								
		Apple		Apple		Apple		



General Information

System Software Installation

You may encounter increased need to install system software at the customer's site. Some systems—currently those with 80 or 160 MB internal SCSI drives—are shipped with the operating system already installed on the hard drive. Replacing these SCSI drives requires reinstalling system software.

Installing System Software Versions 6.0.2 to 6.0.4

Requirements - System Software (ver. 6.0.2, 6.0.3, or 6.0.4)
(System & Printing Tools, Utilities 1 & 2)

- Installation**
1. Insert the System Tools disk in a floppy drive, and turn on the computer.
 2. Double-click on the System Tools disk icon, the Setup Folder, and Installer.
 3. Select the disk you want to install system software onto. Click **Drive** until you see this disk.
 4. Select your computer type and click **Install**.
 5. When done, quit the Installer and reboot.

Installing System Software Version 6.0.5 or Later

The Installer has Easy Install and Customize options. Easy Install automatically installs system and printer software that is appropriate for the destination disk and your computer. **You must use the Customize option to install AppleShare® workstation software.** The Customize option can also be used to create a boot disk with the minimal software required for any Macintosh system.

Requirements - System Software (ver. 6.0.5 or later)
(System & Printing Tools, Utilities 1 & 2, & HyperCard®)

- Installation**
1. Insert the System Tools disk in a floppy drive, and turn on the computer.
 2. Double-click on the System Tools disk icon and on the Installer.
 3. When the welcome screen appears, click **OK**.
 4. Select the disk you want to install system software onto. Click **Switch Disk** until you see this disk.

Easy Install

5. Click **Install**. The appropriate software is automatically installed.
6. When done, quit the Installer and reboot.

Customize

5. Click **Customize**. Then select (click or shift-click) the software you wish to install from the options listed in the scrollable window.
6. Click **Install**. The selected software is then installed.
7. When done, quit the Installer and reboot.

General Information

System-Software Compatibility



System-Software Configurations

Macintosh Model	Recommended Versions	Acceptable Versions
128K	System 2.0/Finder 4.1	
512K	System 3.2/Finder 5.3	
512Ke	System 3.2/Finder 5.3 System 3.3/Finder 5.4 System 3.4/Finder 5.4	System 4.0/Finder 5.4 System 4.1/Finder 5.5
Plus	System 6.0.2/Finder 6.1 System 6.0.3/Finder 6.1 System 6.0.4/Finder 6.1 System 6.0.5/Finder 6.1	System 3.2/Finder 5.3 System 3.3/Finder 5.4 System 4.0/Finder 5.4 System 4.1/Finder 5.5 System 4.2/Finder 6.0
SE	System 6.0.2/Finder 6.1 System 6.0.3/Finder 6.1 System 6.0.4/Finder 6.1 System 6.0.5/Finder 6.1	System 4.0/Finder 5.4 System 4.1/Finder 5.5 System 4.2/Finder 6.0
SE/30	System 6.0.3/Finder 6.1 System 6.0.4/Finder 6.1 System 6.0.5/Finder 6.1	
II	System 6.0.2/Finder 6.1 System 6.0.3/Finder 6.1 System 6.0.4/Finder 6.1 System 6.0.5/Finder 6.1	System 4.1/Finder 5.5 System 4.2/Finder 6.0
IIx	System 6.0.3/Finder 6.1 System 6.0.4/Finder 6.1 System 6.0.5/Finder 6.1	
IIfx	System 6.0.5/Finder 6.1	
IIcx	System 6.0.3/Finder 6.1 System 6.0.4/Finder 6.1 System 6.0.5/Finder 6.1	
IIci	System 6.0.4/Finder 6.1 System 6.0.5/Finder 6.1	
Portable	System 6.0.5/Finder 6.1	System 6.0.4/Finder 6.1



General Information

Diagnostics—MacTest

When used as standalone tests, the *MacTest* diagnostic programs perform pass/fail functional tests of the Macintosh computer systems. The procedures for using all *MacTest* programs are similar, but not identical. **Be sure to use the *MacTest* program for the system you want to test.** The information on the following pages summarizes how to hook up test equipment and run the *MacTest* programs. For more detailed information, see the *Apple Service Technical Procedures*.

Things to Remember

1. Use the Finder to make a backup copy of the *MacTest* disk. (If using a Macintosh/Macintosh Plus, use the appropriate disk copy program on the *MacTest* disk.) Do not write-protect your working disk.
2. Do not replace the System and Finder files on the *MacTest* disk.
3. Before running *MacTest*, close all Desk Accessories. Also note that most versions of *MacTest* are not compatible with MultiFinder™.
4. *MacTest* cannot test an internal SCSI hard drive or an external drive connected to a Hard Disk 20.
5. If you cannot boot the *MacTest* disk:
 - a. Check the power cable and internal cable connections.
 - b. Refer to the Symptom/Cure Chart, and replace the module(s) specified for your problem.
6. **(Macintosh / Macintosh Plus only)** If you receive an **error code** while attempting to run *MacTest*, **refer to Macintosh / Macintosh Plus MacTest Error Codes** to correct the problem.
7. **(Macintosh Portable only)** The power adapter must be connected to the Macintosh Portable for the *AppleCat/MacTest* diagnostic to operate.
8. If the desktop appears instead of the *MacTest* window, open the *MacTest* disk icon and highlight the *MacTest* file icon, select **Set Startup** from the Special menu, and reboot with the *MacTest* disk.
9. Loopbacks are not needed to run *MacTest*, but are necessary to thoroughly test the system. **Power off the system when you connect a SCSI loopback card.**
10. If a logic board test is selected but the loopbacks are not installed, click **OK** in the dialog box that appears. Then deselect the logic board test, or **turn off power to the system** and install the loopback equipment.
11. Do not press the reset or interrupt switch while the RAM test is running. Pushing reset causes the RAM test to fail, and pressing interrupt could damage the *MacTest* disk.
12. After completing the repair, always run *MacTest* to verify that there are no other faults.

General Information

Diagnostics—MacTest



Running MacTest

1. (**Portable only**) Plug in the power adapter and connect it to the Portable.
2. Connect the following loopback equipment (**see Figures on next page**):
 - DB-9 serial port plugs (2) to serial ports (**Macintosh 128K/512K only**), or serial loopback cable (Mini DIN-8 cable) between serial ports.
 - SCSI loopback test card to SCSI port. (The Macintosh 128K/512K does not have SCSI circuitry, and the Portable does not require using the SCSI loopback test card.)
3. (**Portable only**) Reset the power manager by simultaneously depressing and then releasing the reset and interrupt switches.
4. Boot the *MacTest* disk.
5. Select tests from the Test Selections menu.
6. To loop on selected tests, select **Auto Run Selected** from the Options menu (**Macintosh / Macintosh Plus only**) or **Loop on selected tests** from the Test Selections window.
7. Click **Start**.

Macintosh / Macintosh Plus MacTest Error Codes

Before using this chart, verify that you are using a known-good *MacTest* disk. X's in the codes can represent any number.

Error Code	Corrective Checks and Actions
100xx.xxxx	<ol style="list-style-type: none">1. Check that keyboard is connected.2. Replace keyboard cable.3. Replace keyboard.4. Replace logic board.
200xx.xxxx 300xx.xxxx	<ol style="list-style-type: none">1. Check that loopback connectors are installed.2. Check that cables are connected.3. Check that loopback connectors are good.4. Replace logic board.
400xx.xxxx	<ol style="list-style-type: none">1. Check that <i>MacTest</i> disk is unlocked.2. Replace internal disk drive.
500xx.xxxx	<ol style="list-style-type: none">1. Check that blank, formatted 400K disk is in external disk drive before running test.2. Check that blank disk is unlocked.3. Replace external disk drive.
600xx.xxxx	Replace logic board.
800xx.xxxx (Mac Plus only)	<ol style="list-style-type: none">1. Check that SCSI loopback test card is connected.2. Check that cables are connected.3. Check that SCSI loopback card is good.4. Replace logic board.



General Information

Diagnostics—MacTest Hookups

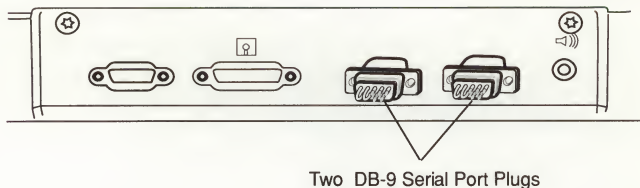


Figure: Macintosh 128K/512K *MacTest* Hookup

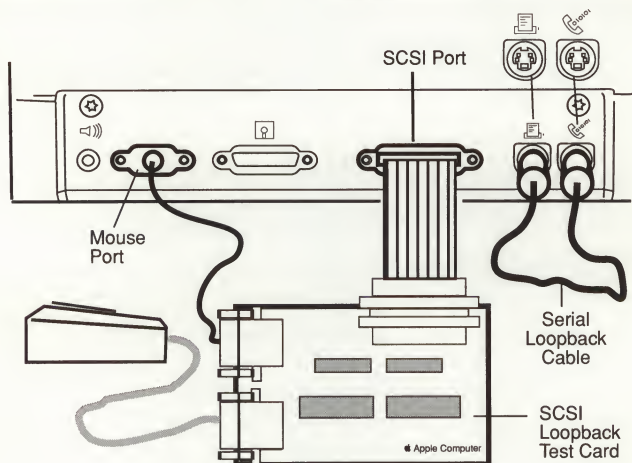


Figure: Macintosh Plus *MacTest* Hookup

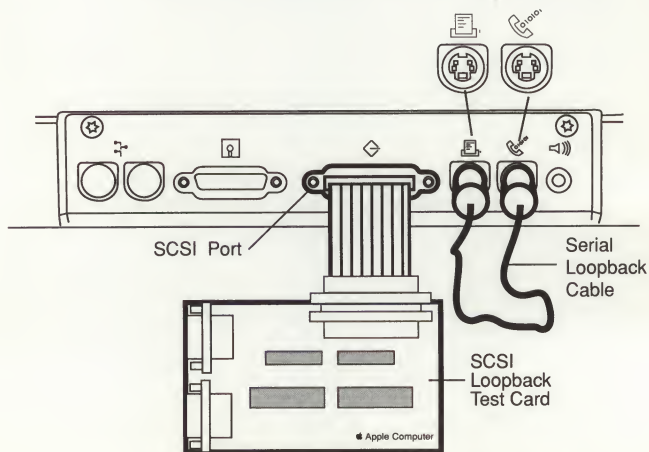


Figure: Macintosh SE & SE/30 *MacTest* Hookup

General Information

Diagnostics—MacTest Hookups

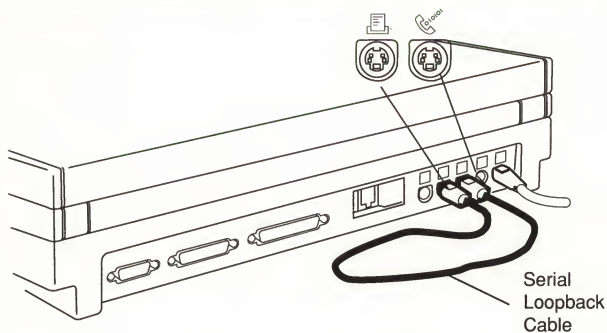


Figure: Macintosh Portable *MacTest* Hookup

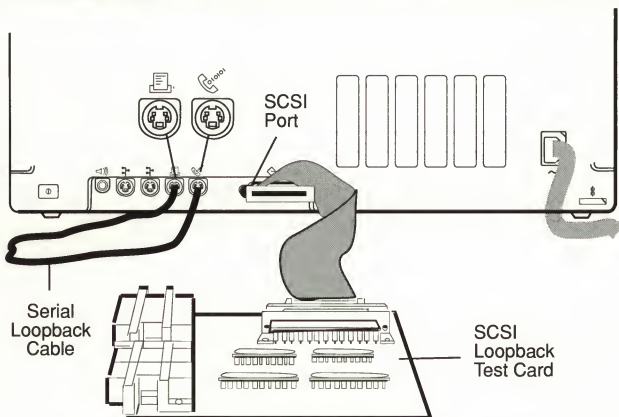


Figure: Macintosh II/Ix/IIfx *MacTest* Hookup

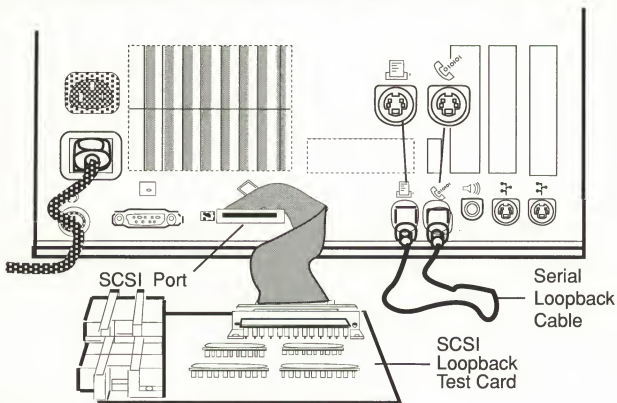


Figure: Macintosh IIcx/IIfx *MacTest* Hookup



General Information

Diagnostics—SCSI Loopback Jumper

The SCSI loopback card must be jumpered between J1 pin 25 and RP1 pin 14 in order to be used with *MacTest*. New loopback cards have the jumper etched into the card's circuitry. Older versions of the card need the jumper installed.

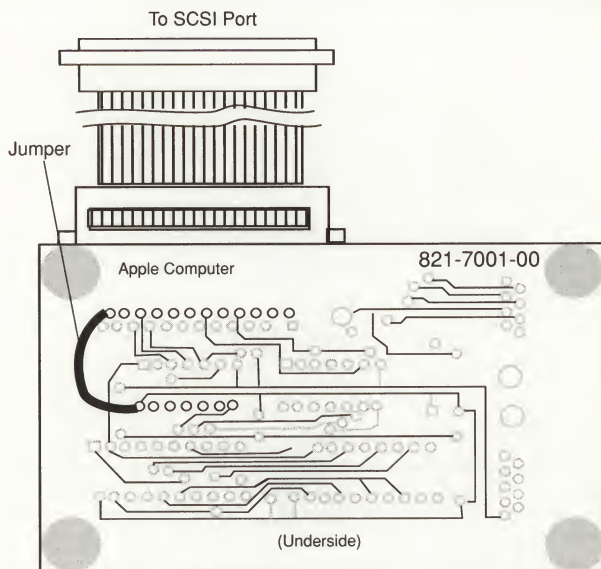


Figure: Older SCSI Loopback Card with Jumper

Determining if a Jumper is Needed

1. Look at the part number on the back of the SCSI loopback card.
2. If the part number ends with the letter **A**, the jumper is included in the card circuitry.
3. If the part number ends with double zeros **00**, check to see if the card has an external jumper installed from J1 pin 25 to RP1 pin 14. If there is no external jumper, install one.

Installing the Jumper

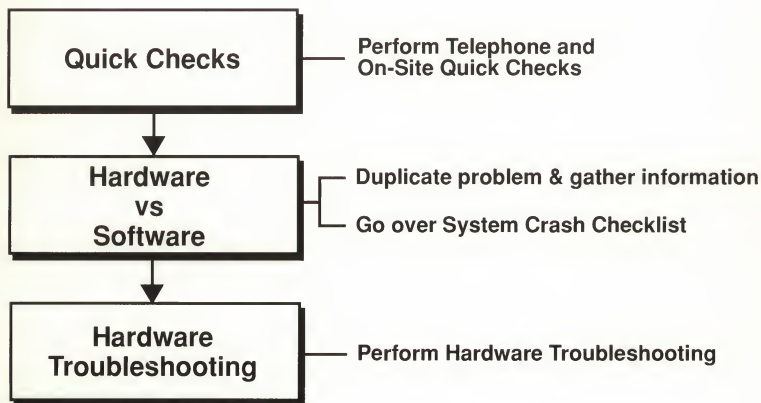
1. Locate J1 pin 25 and RP1 pin 14 on the SCSI loopback card (**see Figure**). J1 pin 25 is the pin closest to the upper-left corner of the card; RP1 pin 14 is in the middle line of pins and closest to the left edge of the card.
2. Solder a wire connection between J1 pin 25 and RP1 pin 14 on the SCSI loopback card.

General Information

On-Site Troubleshooting



On-Site Troubleshooting—Overall Approach



Telephone and On-Site Quick Checks

- ✓ Check the power source and power connection.
- ✓ Check all cables and cable connections.
- ✓ Check the adjustment of all user controls.
- ✓ Check that not more than one system file is on the startup device/disk.
- ✓ Check that the computer system and the system software are compatible (**see the System-Software Configurations table in this section**).
- ✓ Open the computer and verify that all circuit boards, fuses, and chips are secure, clean, and undamaged.

Differentiating Software Problems from Hardware Problems

When quick checks do not identify the problem, try duplicating the problem (or have your customer duplicate the problem) and gather as much information as possible. Note the following:

- Operating condition of the system when the problem occurs (application and version being run; under Finder or Multifinder; system software and version installed; whether networked; system configuration and attached peripherals; INITs, CDEVs, and DA's installed; etc.)
- What your customer is doing, *exactly*, when the problem occurs
- What happens to the system (freezes, crashes, displays error message)
- What your customer has tried to do to fix the problem, and with what results

Using this information, perform appropriate solutions from the following System Crash Checklist. If this systematic approach does not fix the problem, your customer probably has a hardware problem (**refer to Hardware Troubleshooting later in this section**).



General Information

Software Troubleshooting

System Crash Checklist

- ✓ Check whether the problem is peculiar to one application (try replicating the problem using another application). If the application is at fault, try the following:

<u>Possible Problem</u>	<u>Solutions</u>
Program incompatible with MultiFinder	<ol style="list-style-type: none">1. Try booting offending program first.2. Switch to Finder.
Program incompatible with system software	<ol style="list-style-type: none">1. Revert to older version of system software.2. Remove program from system.3. Contact vendor about program update.
Program corrupted	<ol style="list-style-type: none">1. System crashes can corrupt the program and the system software. Trash the program.2. Reinstall the program and system software from original disks.
Insufficient memory to run program	<ol style="list-style-type: none">1. If under MultiFinder, close other applications and restart program. (You may have to restart the system).2. If under MultiFinder, switch to Finder.3. Allocate more memory to application. (Select application, select Get Info from menu bar, and increase allocated memory in the dialogue box.)
The message "Application is busy or missing" displays	<ol style="list-style-type: none">1. Make sure application is on drive.2. Launch application rather than document. If application launches, it is not corrupted. Rebuild your desktop (see Desktop Procedures and Practices).
Programs (especially DAs, Inits, and CDEVs) conflict	<ol style="list-style-type: none">1. If program was added just prior to problem, remove offending program.2. Remove all DAs, Inits, and CDEVs, and replace one at a time until offender is found (see Desktop Procedures and Practices).

- ✓ Check whether problem is with system software (try booting from a floppy) or with multiple system folders (use Find File under the Apple menu).

<u>Problem</u>	<u>Solution</u>
Multiple system folders	<ul style="list-style-type: none">— Remove all system folders except folder with the Macintosh icon on it (see Desktop Procedures and Practices).
Corrupted system software	<ul style="list-style-type: none">— Replace system software. Use Installer on original system software disks.

General Information

Software Troubleshooting



Desktop Procedures and Practices

Identifying and remedying problems that may be software related requires familiarity with basic desktop management procedures and practices. An inappropriately managed desktop could cause the following problems.

Multiple System Folder Problems

- Symptoms: System crashes, unusual error messages, font and DA lists change unexpectedly.
- Occurs: When disks containing system folders are dragged onto system or system software is loaded without using Installer.
- Remedy: Locate and remove all system folders without the Macintosh icon on the folder; also remove any extra System or Finder files.
- Procedure: Boot from known-good system disk, use Find File DA to locate and then remove multiple system folders, and reboot computer.

INIT and CDEV Conflicts

- Symptoms: System crashes and myriad other problems.
- Occurs: When INIT or CDEV conflicts with an application on system.
- Remedy: Locate and remove all INITs and CDEVs, and then replace them one at a time until the conflict returns.
- Procedure: Place all INITs and CDEVs in a separate folder within system folder (this prevents them from loading when booting system), and return each INIT and CDEV to system folder one at a time. (Renaming an INIT, such as prefixing it with a "Z" so it loads last, sometimes remedies conflict.)

RAM Cache Out-of-Memory Problems

The RAM cache is a Control Panel feature that speeds up the operation of the system. The RAM cache acts as a special RAM buffer between applications and disk drives. From 32K to 768K of the most frequently used blocks of data can be stored in the RAM cache, which can significantly increase speed within an application and will cause applications to launch from and return to the Finder more quickly. Memory problems can occur when the RAM cache is set too high.

- Symptoms: Insufficient memory problems, applications won't run, degraded system performance, ID=28 system bombs in systems configured with 1 MB or less of memory.
- Occurs: When RAM cache is set too high (available system memory is insufficient to run program).
- Remedy: Turn off RAM cache, or reduce amount of memory allocated to RAM cache.
- Procedure: Open Control Panel and set RAM cache up or down as desired, and then reboot system.



General Information

Software/Hardware Troubleshooting

Rebuilding the Desktop / Slow Finder

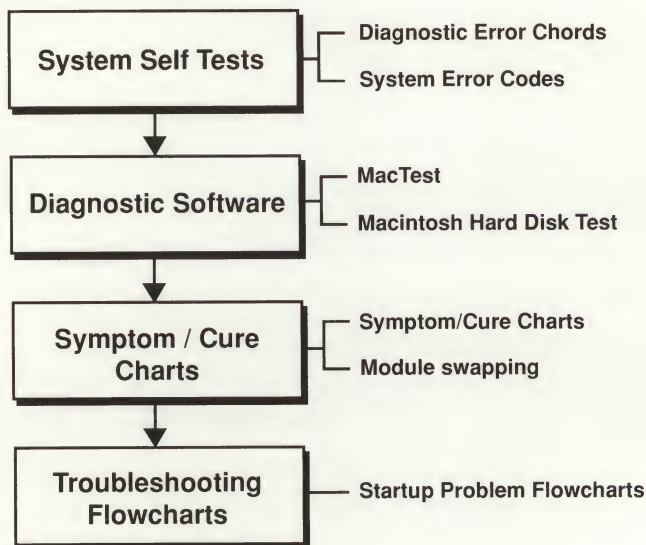
- Symptoms:** Finder cannot locate applications that are on disk drive, or Finder is slow.
- Occurs:** When disk is overloaded with applications and icons, or applications contain excessive number of file comments.
- Remedy:** Rebuild desktop file (which erases comments from Get Info comment box of all applications on drive).
- Procedure:** Hold down <Option> and <Command> keys while booting, or while quitting application. Click **Yes** in resulting dialog box (to rebuild the desktop).

Resetting Corrupted Parameter RAM

When an application crashes it sometimes executes code that corrupts parameter RAM on Macintosh II systems running system software prior to release 5.0. PRAM contains information (a default value) required by the Macintosh operating system to start up from an internal SCSI drive.

- Symptoms:** Macintosh II will not boot from internal SCSI drive.
- Remedy:** Reset parameter RAM to its default values.
- Procedure:** Hold down <Shift>, <Option>, and <Command> keys while opening Control Panel DA. Click **Yes** in resulting dialog box to zap PRAM, which resets some user options to their default values.

Isolating a Hardware Problem



General Information

Hardware Troubleshooting



- **System Self Tests**—Start up the customer's system, listen for diagnostic error chords (see **Flowchart 2, Startup and Error Chords, in this section**), and look for system error codes (refer to **System Failure Codes in this section**).
- **Diagnostic Software**—If the system passes the self tests but the problem persists, try running the appropriate *MacTest* program (see **Diagnostics—MacTest in this section**). If you suspect a hard disk problem, you should also run the *Macintosh Hard Disk Test* program.
- **Symptom Charts/Module Swapping**—If the customer's system (or *MacTest*) will not boot or *MacTest* fails to find the problem, refer to **Symptom/Cure Charts in this section**. If you think you recognize the problem and you have the necessary replacement module with you, try module swapping.
- **Troubleshooting Flowcharts**—If the customer's system (or *MacTest*) will not boot or *MacTest* fails to find the problem and the problem is not clearly defined or not listed in the Symptom/Cure Charts, refer to **Troubleshooting—Startup Problems flowchart at the end of this section**. This flowchart presents a step-by-step procedure for isolating the problem.

Hardware Troubleshooting Guidelines

1. Use only known-good test equipment and diagnostic programs.
2. The troubleshooting tools are designed to test a system in its minimum configuration. Disconnect external peripherals and remove all NuBus cards. After verifying that the computer is fully operational, reinstall/reconnect and test each expansion card and external device one at a time.
3. When using the Symptom/Cure Charts, always try the solutions one at a time, in sequence, until you fix the problem. If the problem remains, reinstall the original module before trying the next solution.
4. The hardware troubleshooting flowcharts verify each repair action by looping back to the start (Flowchart 1). If a repair does not fix the problem, reinstall the original module, return to the flowblock of origin, and perform the next repair action on the list.
5. When instructed to replace the **logic board only**, place the customer's SIMMs on the replacement logic board. Be sure to use the SIMM removal tool (see **Special Tools Index in this section**). To test the customer's SIMMs, refer to **Flowchart 3, SIMM Verification, in this section**.
6. Always verify that the original problem has been fixed by duplicating the conditions under which it appeared. Run *MacTest* to verify no additional faults.



General Information

System Failure Codes

You can encounter three types of Macintosh system failure codes: **boot ("Sad Mac") failures**, **system failures**, and **application failures**. Explanations of these error codes can be found in the following tables. Extracting useful repair information from the codes, however, usually requires gathering contextual data about what has gone wrong (the error ID can help with this), when it went wrong (what was the computer attempting to do?), and the software and hardware being used when it failed. Suggestions that may help isolate the problem accompany the tables. **If these suggestions do not help, refer to the troubleshooting flowcharts later in this section.**

Sad Mac Error Codes

If the Macintosh fails at startup you will get a "Sad Mac" icon (see the **Figure on the next page**) and a six digit error code. Sad Mac error codes can mean that the computer has failed the internal diagnostic tests and you have a hardware problem. Sad Mac codes can also have less serious causes (see the next page).

Sad Mac Error Codes			
Code	Meaning	Code	Meaning
01 ____	ROM test failure	0F0006	Overflow trap - TRAPV instruction ²
02 ____	RAM test failure (bus subtest) ¹	0F0007	Privilege violation ²
03 ____	RAM test failure (byte write) ¹	0F0008	Trace trap ²
04 ____	RAM test failure (mod3 test) ¹	0F0009	Trap dispatcher error ²
05 ____	RAM failure (address uniqueness) ¹	0F000A	Line 1111 trap ²
0F0001	Bus error ²	0F000B	Other trap ²
0F0002	Address error ²	0F000C	Unimplemented trap executed ²
0F0003	Illegal instruction ²	0F000D	Interrupt button, programmer's switch ^{2,3}
0F0004	Zero divide ²	0F0064	Bad System file ^{2,4}
0F0005	Check trap - CHK instruction ²	0F0065	Bad Finder ²

¹ The first two digits indicate a RAM failure; the last four digits identify (in hexadecimal) the suspected bad chip. Try removing the SIMMs, rubbing the connection area with a pencil eraser to improve the connection, and replacing the SIMMs. If this doesn't help, isolate the bad SIMM (refer to **Flowchart 3, SIMM Verification**).

² "0F" indicates a software error—the startup device was spinning before the failure occurred. Try: (1) Restarting the Macintosh with the <Option> and <Command> keys held down (rebuilding the desktop); or (2) Replacing the System file.

³ Check the interrupt button—it could be stuck.

⁴ The startup disk may be missing the System file.

General Information

System Failure Codes



Other Sad Mac possibilities:

1. A non-system disk in the default drive.
2. A bad boot disk.
3. An incompatible system file on the boot disk.
4. No Finder on the boot disk.
5. The programmer's switch is stuck.

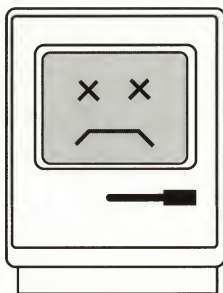


Figure: Sad Mac Icon

System Error Codes

The two-digit system error code is located in the lower-right corner of the dialog box that informs you "A Serious System Error Has Occurred." Serious system failures can be caused by:

- Software problems (damaged program file or program "bugs")
- Data problems (damaged or incomplete data files)
- Hardware problems

Refer to the System Error Codes table for a list of these codes and an explanation of their meaning. These codes and explanations won't tell you what to repair, but they can help lead you to the source of the problem. Probe, ask questions, and explore the specific set of circumstances surrounding the failure.



CAUTION: Interference between an external disk drive and the Macintosh power supply/power supply board can cause system failures. To avoid this interference, always place the external drive on the right side of the Macintosh.



General Information

System Failure Codes

System Error Codes		
Code	Type	Meaning
01	Bus error	Program attempts to access an invalid memory location.
02	Address error	Program attempts to make a long word (two-byte) reference an odd memory address.
03	Illegal instruction	Processor receives an instruction that does not match its internal list of instructions.
04	Zero divide	Programmer told processor to divide by 0 (mathematically impossible).
05	Range check error	Index out of range (for example, programmer declares an array of five elements and searches for the sixth).
06	Overflow	Computer attempts to store a number that is too large for the allotted space.
07	Privilege violation	68000 is running in "user" mode and attempts to execute a command that requires "supervisor" mode.
08	Trace mode error	68000 chip can trace itself for debugging; can interfere with normal execution.
09	Line 1010 trap	Processor cannot execute a ROM call accessed via a trap with a hexadecimal "A" code.
10	Line 1111 trap	An incorrect ROM call.
11	Exception error	A miscellaneous hardware error not covered elsewhere.
12	Unimplemented core routine	Occurs when program attempts to execute a ROM call via an undefined trap.
13	Uninstalled interrupt	Needed routines are not available or the interrupt switch is pressed when a runtime debugger is not present.
14	I/O core error	Error in the file system or the device manager system.
15	Segment loader error	System could not load needed segment from disk into RAM memory.
16	Floating point error	A mathematical error.
17-24	Packages not present (0-7)	System tries/fails to read special sections of the system file called packages; System file may be damaged.
25	Memory full	Program requests a chunk of memory, but the system couldn't find enough.
26	Bad program launch	Attempt to load program without a CODE resource of 0; program is not a real program.
27	File system map damaged	
28	Stack ran into heap	Two competing areas of memory, the stack and heap, have collided. You're out of memory.
30	Disk insertion error	
31	No disk insertion	
41	Finder error	Attempt to boot with startup disk that does not contain the Finder. Create new startup disk.
32-56	Memory mgr errors	
100	Mount volume error	Bad system file.

General Information

System Failure Codes



Application Error Codes

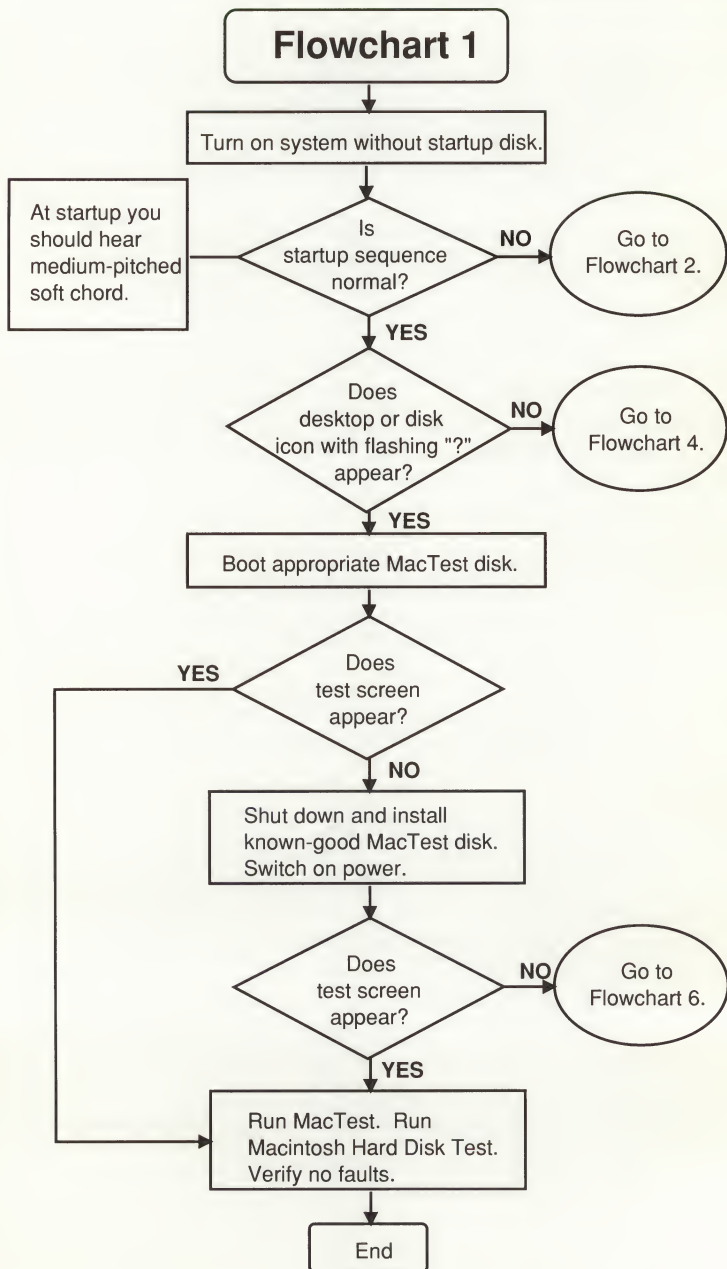
Rather than give you an error message such as "The disk is locked," you may occasionally receive a negative value error code such as -44 (which also means the disk is locked). Refer to the Application Error Codes table below for these codes and their meanings.

Application Error Codes			
Code	Meaning	Code	Meaning
-33	File directory full; folder cannot hold any more files.	-47	File is busy; one or more files are open.
-34	Volume/disk is full.	-48	File with specified name/version number already exists.
-35	Specified volume does not exist.	-49	Attempt to open two paths to the same file for writing.
-36	I/O error.	-50	Parameter block error.
-37	Bad file or volume name.	-51	File reference number does not exist.
-38	Attempt to read or write an unopened file.	-53	Specified volume (disk) is not present in any drive.
-39	Logical end-of-file reached during read operation.	-54	Attempt to open a locked file for writing.
-40	Attempt to move before start of file.	-56	No such device.
-41	Memory full.	-57	Not a Macintosh disk; volume lacks Macintosh-format directory.
-42	Attempt to open too many files.	-59	Attempt to rename a file failed.
-43	File not found.	-60	Bad master directory; must reinitialize volume (disk).
-44	Volume is locked by a hardware setting; the disk is write-protected.	-61	Read/write or open permission does not allow writing.
-45	File is "locked."	-64	Drive isn't connected.
-46	Volume/disk is locked by a software flag.		



General Information

Troubleshooting—Startup Problems



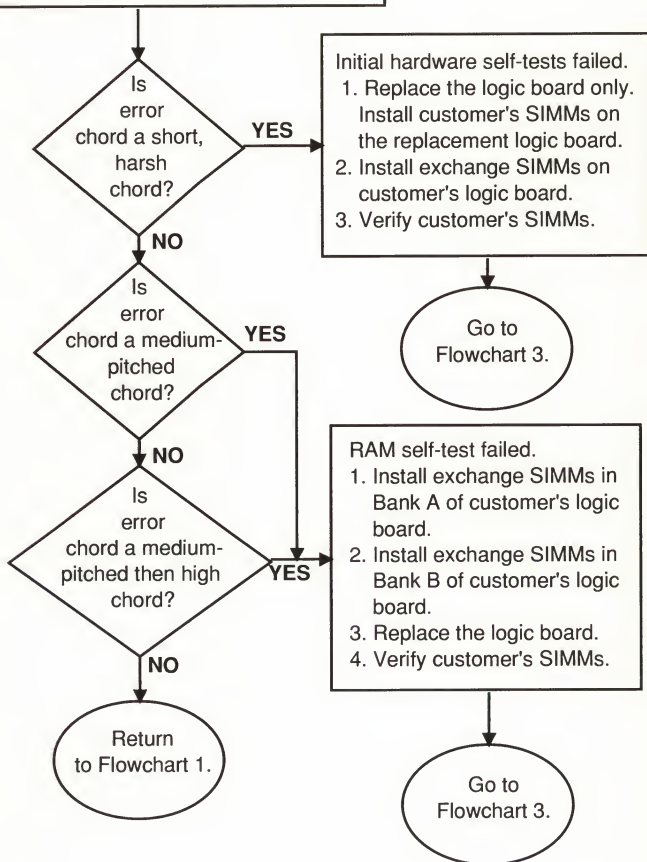


Flowchart 2 (Startup & Error Chords)

If an error is encountered at startup you will hear:

- First, a medium pitched, soft startup chord (normal)
- Second, an error chord (not normal)
- Third, a test monitor chord (4 chords, low to high)

Pay close attention to the error (second) chord.

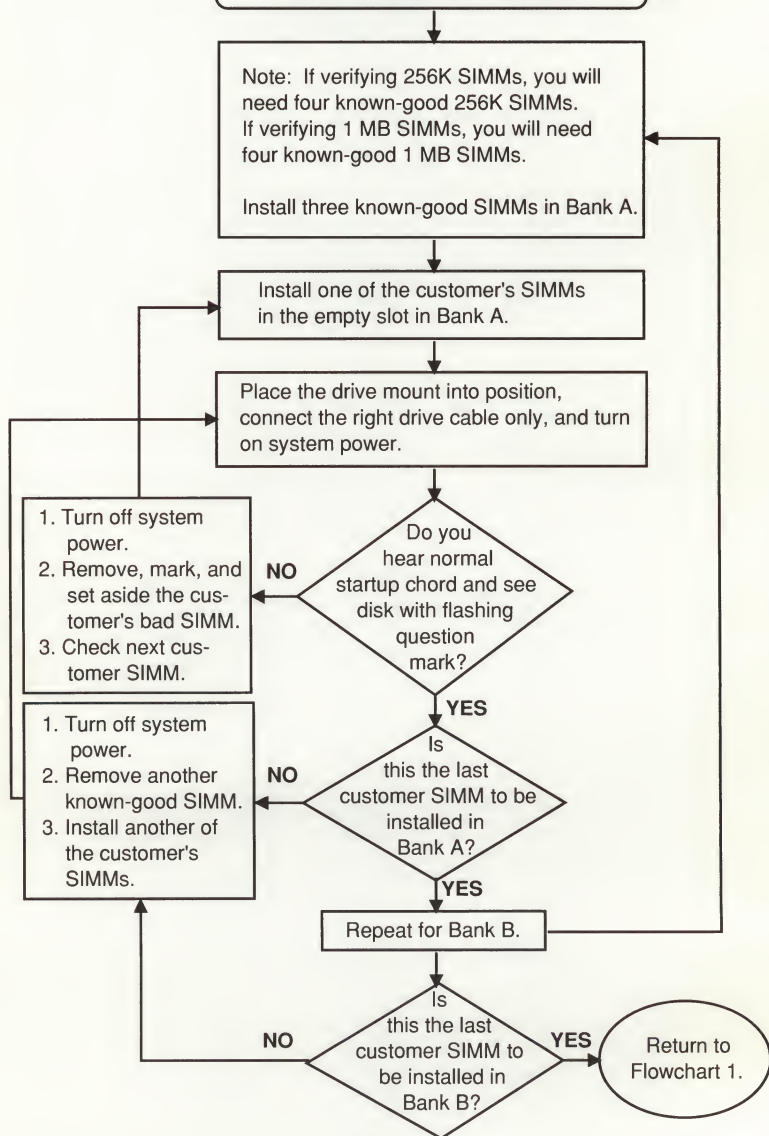




General Information

Troubleshooting—Startup Problems

Flowchart 3 (SIMM Verification)



General Information

Troubleshooting—Startup Problems

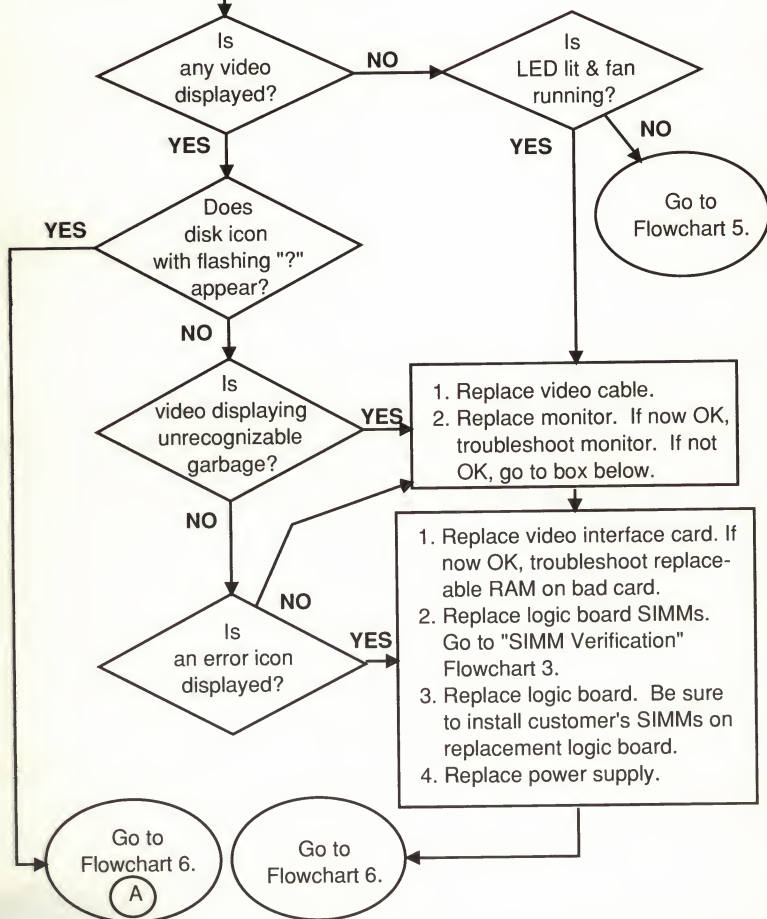


Flowchart 4

Note: Suspected problem areas include system video, system logic and control, and system power.

- Disconnect SCSI power & cable connectors.
- Disconnect disk drive 2 cable.
- Run system from drive 1 only.

Turn on system without startup disk.





General Information

Troubleshooting—Startup Problems

Flowchart 5

Note: Suspected problem areas include system power, system logic and control, and system video.

Turn off system power, remove the top cover, and check the two lithium batteries with a voltmeter. The batteries must read 3.2 volts or higher on the voltmeter.

Are
batteries
OK?

YES

1. Replace power supply.
2. Replace logic board. Be sure to install customer's SIMMs on replacement logic board.

Go to
Flowchart 7.

NO

Replace bad batteries
and continue procedure.

Is
LED lit & fan
running?

NO

YES

Does
desktop or disk
icon with flashing
"?" appear?

NO

YES

Go to
Flowchart 7.

1. Replace video cable.
2. Replace monitor. If now OK, troubleshoot monitor.
3. Replace video interface card. If now OK, troubleshoot replaceable RAM on bad card.
4. Replace logic board SIMMs. Go to "SIMM Verification" Flowchart 3.
5. Replace logic board. Be sure to install customer's SIMMs on replacement logic board.
6. Replace power supply.

Return to
Flowchart 1.

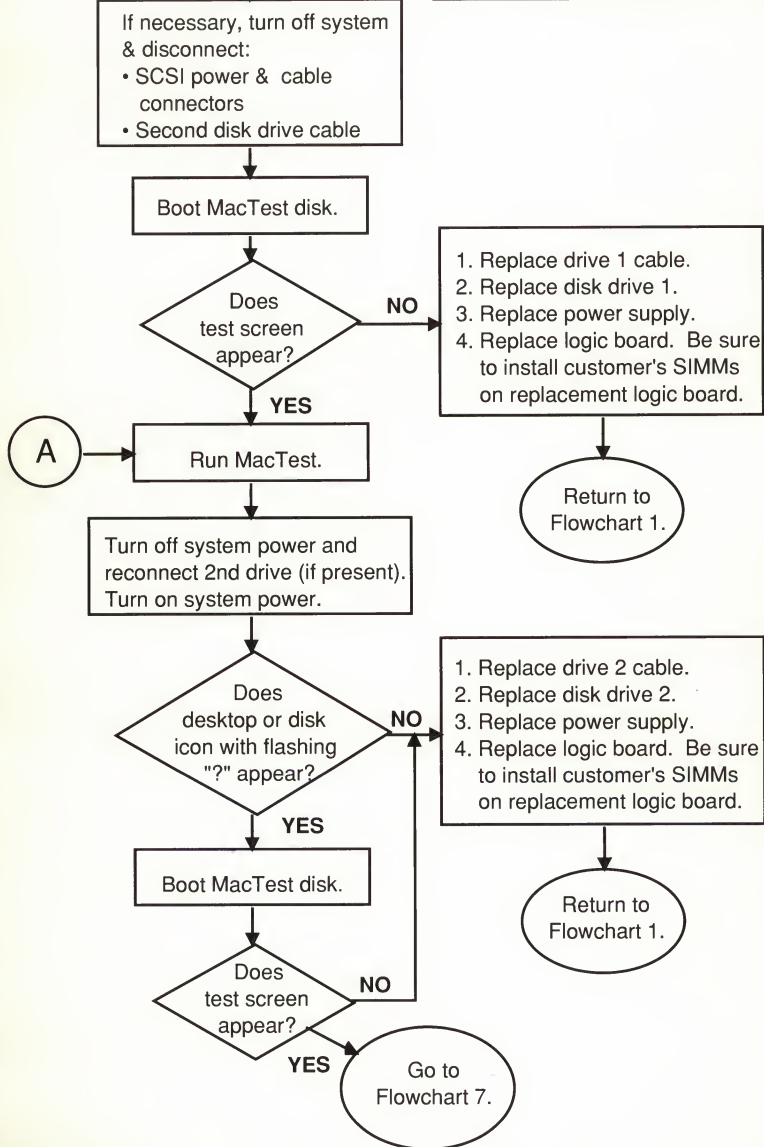
General Information

Troubleshooting—Startup Problems



Flowchart 6

Note: Suspected problem areas include the input/output devices, SCSI drive, system power, and system logic and control.



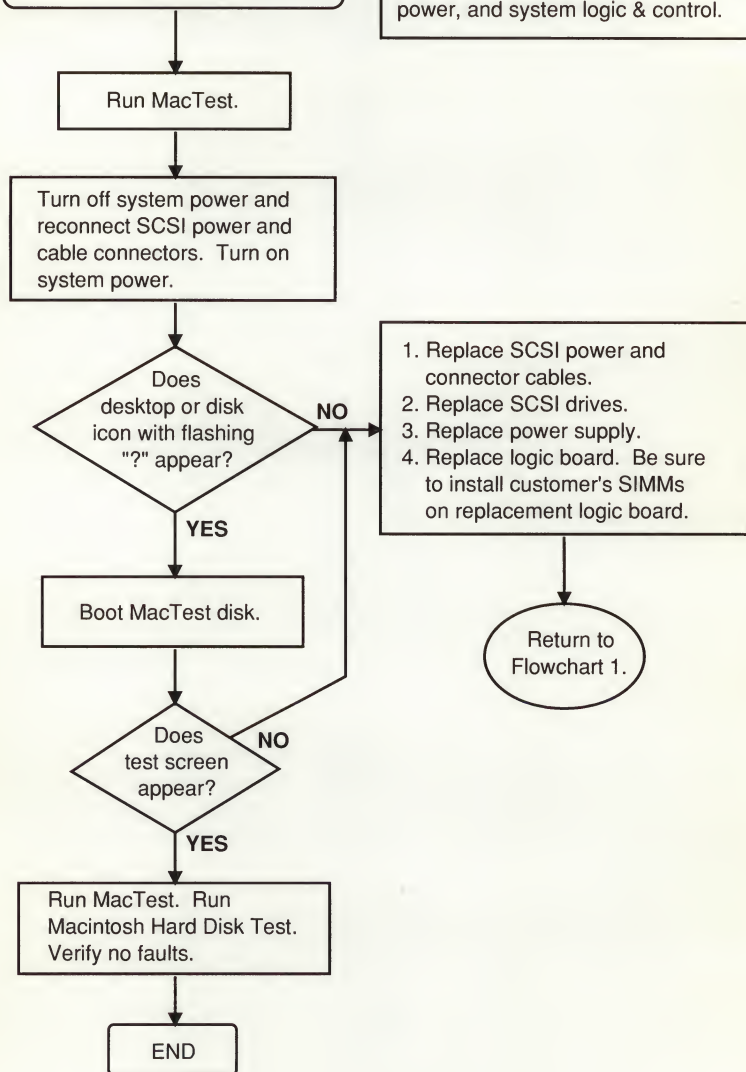


General Information

Troubleshooting—Startup Problems

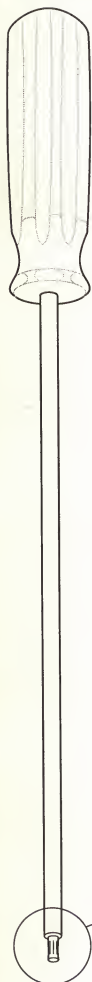
Flowchart 7

Note: Suspected problem areas include the SCSI drive, system power, and system logic & control.

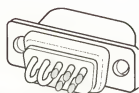


General Information

Special Tools Index

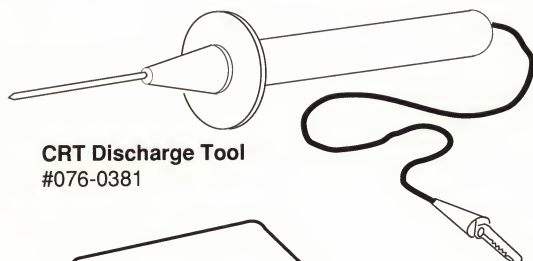
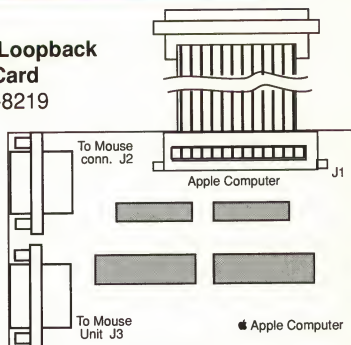


Torx Driver
#076-8053

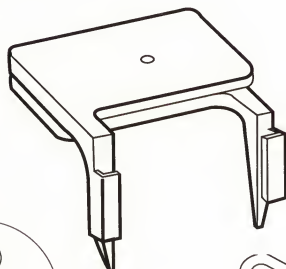


DB9 Serial Port Plug
(set of 2) #077-8129

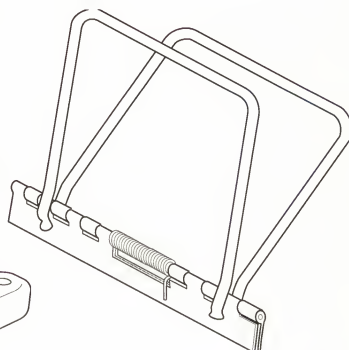
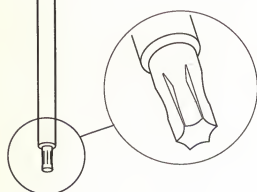
**SCSI Loopback
Test Card**
#077-8219



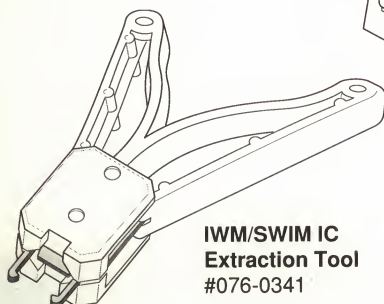
CRT Discharge Tool
#076-0381



SIMM Removal Tool
#076-8354



Pull-Apart Tool
#076-8059

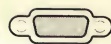


**IWM/SWIM IC
Extraction Tool**
#076-0341

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or other markings on the paper.

Ports and Cables

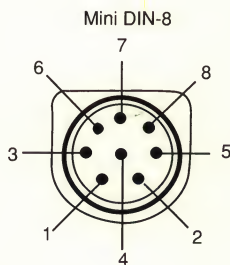
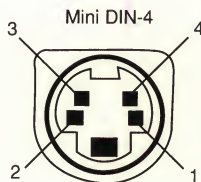
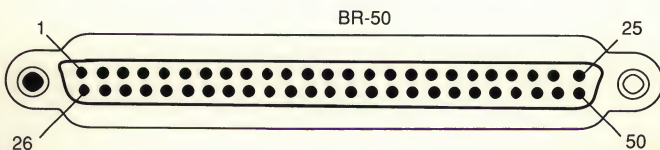
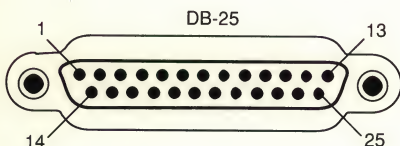
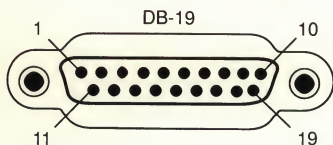
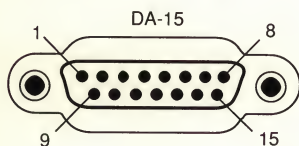
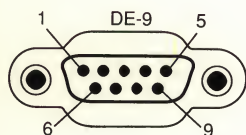
Table of Contents/Cable Connectors

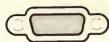


Contents	Page
Cable Connectors	1
Peripheral Cables	2
Table of Peripheral Cables	3
External Connectors	4
External Connectors—Pin-Outs	5-12

Cable Connectors

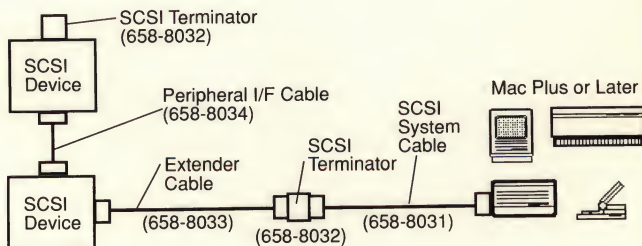
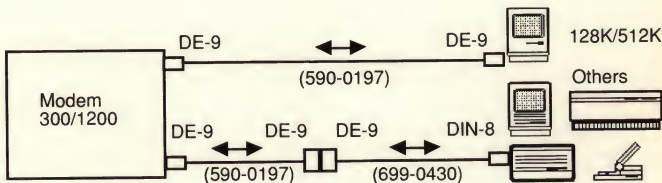
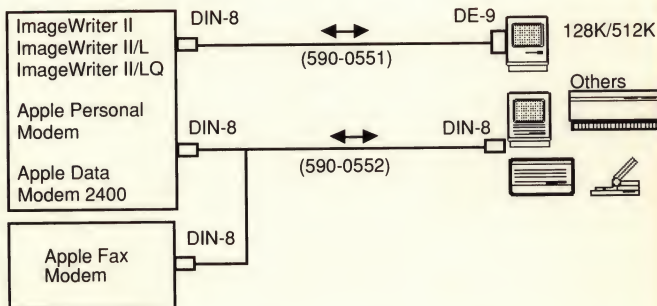
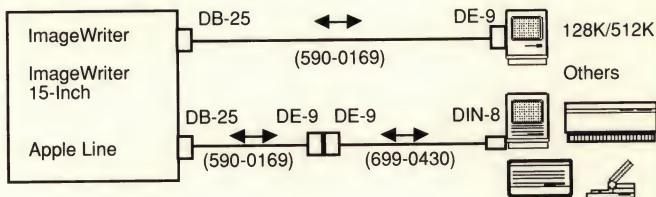
The pin numbers shown below are for the connectors attached to the ends of the Macintosh peripheral cables, as viewed from the front of the connector.





Ports and Cables

Peripheral Cables



Ports and Cables

Table of Peripheral Cables



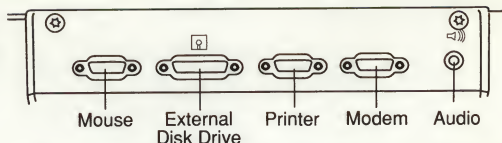
	Service Part #		Cable Information		
	Macintosh 128K/512K	Macintosh Plus and Later	Model #	Color	Type
ImageWriter[®], ImageWriter 15-Inch, AppleLine[™]	590-0169	590-0169	M0150	Medium Brown	DE-9 to DB-25 Male to Male
		and			
		699-0430 590-0553 or 590-0341	M0199	Smoke	Mini DIN-8 to Mini DE-9 Male to Female (adapter cable)
ImageWriter II, II/L, & II/LQ, Apple Personal Modem, Apple Data Modem 2400	590-0551 or 590-0332		M0196	Smoke	Mini DIN-8 to DE-9 Male to Male
			M0185	Beige	
		590-0552 or 590-0340	M0197	Smoke Beige	Mini DIN-8 to Mini DIN-8 Male to Male
AppleFax[™] Modem		590-0552 or 590-0340	M0197	Smoke Beige	Mini DIN-8 to Mini DIN-8 Male to Male
Modem 300/1200	590-0197	590-0197	M0170	Medium Brown	DE-9 to DE-9 Male to Male
		and			
		699-0430 590-0553 or 590-0341	M0199 M0189	Smoke Beige	Mini DIN-8 to Mini DE-9 Male to Female (adapter cable)
SCSI Devices (system cable)		658-8031 590-0305 or 590-0345	M0206	Smoke Beige	BR-50 to DB-25 Male to Male
SCSI Devices (terminator)		658-8032 590-0304 or 590-0344	M0209	Smoke Beige	BR-50
SCSI Devices (cable extender)		658-8033 590-0307 or 590-0347	M0208	Smoke Beige	BR-50 Male to Female
SCSI Devices (peripheral I/F cable)		658-8034 590-0306 or 590-0346	M0207	Smoke Beige	BR-50 Male to Male



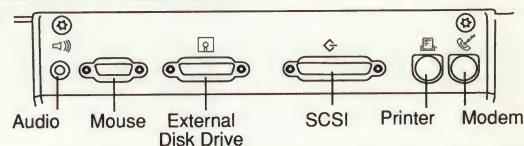
Ports and Cables

External Connectors

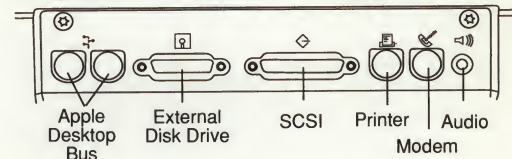
Macintosh 128K, 512K, 512K enhanced



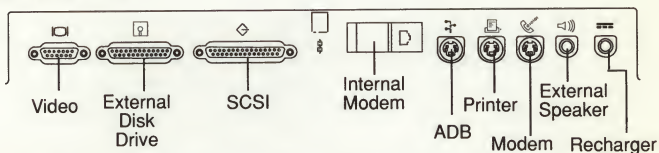
Macintosh Plus



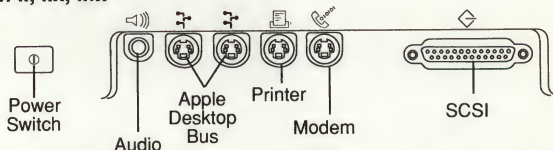
Macintosh SE & SE/30



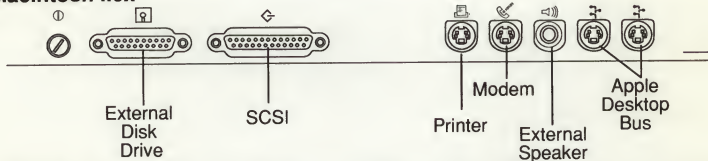
Macintosh Portable



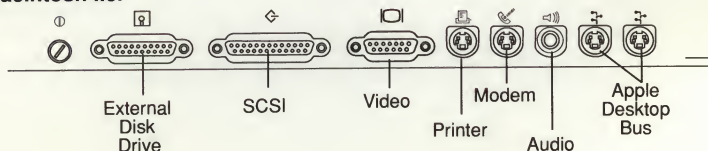
Macintosh II, IIx, IIcx



Macintosh IIcx



Macintosh IIfx



Ports and Cables

External Connectors—Pin-Outs



Mouse Connector *

Pin	Signal	Signal Description
1	GND	Signal ground
2	+5V	+5 volts
3	GND	Signal ground
4	X2	Left-to-right motion indicator
5	X1	Interrupt line (left-to-right motion)
6	NC	No connection
7	SW	Mouse button
8	Y2	Up/down motion indicator
9	Y1	Interrupt line (up/down motion)

*This male DE-9 connector is present on the Macintosh 128K, 512K, and 512K enhanced.

Apple Desktop Bus Connector *

Pin	Signal	Signal Description
1	Data	Bidirectional data bus
2†	Power On	Signal momentarily grounded to pin 4 to begin power-up sequence in CPU
3	Power	+5 volts
4	Ground	Signal ground

*The ADB connector (Mini DIN-4 male) is present on the entire Macintosh family of computers except the Macintosh 128K, 512K, and 512K enhanced.

† Pin 2 is unused on the Macintosh, Macintosh Plus, SE, SE/30, and Portable.



Ports and Cables

External Connectors—Pin-Outs

External Disk Drive Connector *

Pin	Signal	Signal Description
1	GND	Signal ground
2	GND	Signal ground
3	GND	Signal ground
4	GND	Signal ground
5	-12V	-12 volts DC
6	+5V	+5 volts DC
7	+12V	+12 volts DC
8	+12V	+12 volts DC
9	NC	No connection
10	PWM	Motor speed control
11	PH0	Command control line
12	PH1	Command control line
13	PH2	Command control line
14	PH3	Command control line
15	WRREQ/	Write request
16	HDSEL	Head select
17	ENBL2/	Read line enable
18	RD	Read data
19	WR	Write data

* This male DB-19 connector is present on all Macintosh computers except the Macintosh II, IIx, and IIcx. The external disk drive connects the following:

- 400K external drive to Macintosh 128K, 512K, 512K enhanced, Plus, SE, and Portable
- 800K/Apple 3.5 Drive to Macintosh 512K enhanced, Plus, SE, SE/30, IIcx, IIci, and Portable
- FDHD SuperDrive to SE/30, IIcx, IIci, Portable, and upgraded Macintosh SE
- Apple Hard Disk 20 to Macintosh 512K, 512K enhanced, Plus, and SE.

Ports and Cables

External Connectors—Pin-Outs



Modem/Printer Connectors (DB-9) *

Signal Name RS-422

Pin	Signal	Signal Description
1	GND	Signal ground
2	+5V	+5 volts
3	GND	Signal ground
4	TXD+	Transmit data +
5	TXD-	Transmit data -
6	+12V	+12 volts
7	HSKi	Handshake input
8	RXD+	Receive data +
9	RXD-	Receive data -

* This male DE-9 connector is present on the Macintosh 128K, 512K, and 512K enhanced.

Modem/Printer Connectors (DB-9) *

Signal Name RS-232

Pin	Signal	Signal Description
1	FG	Frame ground
2	NC	No connection
3	SG	Signal ground
4	NC	No connection
5	TXD	Transmit data
6	NC	No connection
7	DSR	Data set ready
8	NC	No connection
9	RXD	Receive data

* This male DE-9 connector is present on the Macintosh 128K, 512K, and 512K enhanced.



Ports and Cables

External Connectors—Pin-Outs

Modem/Printer Connectors (DIN-8) *

Pin	Signal	Signal Description
1	HSKo	Handshake output; connected to SCC data terminal ready
2	HSKi	Handshake input; connected to SCC clear to send and transmit/receive clock
3	TxD-	Transmit data (inverted); connected to SCC transmit data; tri-stated when request to send is deasserted
4	SG	Signal ground; connected to logic and chassis ground
5	RxD-	Receive data; connected to SCC receive data
6	TxD+	Transmit data; connected to SCC transmit data; tri-stated when request to send is deasserted
7	GPI	General-purpose input; connected to SCC data carrier detect (or to receive/transmit clock if the VIA1 SYNC signal is high)
8	RxD+	Receive data; connected to the SCC receive data

* This Mini DIN-8 (male) connector is present on the Macintosh Plus, SE, SE/30, II, IIx, IIcx, IIfx, IIci, and Portable. To connect DE-9 cables to the Mini DIN-8 port, use adapter cable 590-0341 (beige) or 590-0553/699-0430 (smoke).

Ports and Cables

External Connectors—Pin-Outs



Audio Connector—Monaural *

Pin	Signal	Signal Description
(Sleeve)	GND	Signal ground
(Tip)	AUDIO	.5-volt peak-to-peak audio signal

* This monaural, miniature phono plug is present on the Macintosh 128K/512K/512K enhanced, Plus, and SE. The internal speaker is disabled when this connector is being used.

Audio Connector—Stereo¹

Pin	Signal	Signal Description
(Sleeve)	GND	Signal ground
(Tip)	Left	1-volt peak-to-peak audio signal with an impedance of 47 ohms ² ; left channel
(Ring)	Right	1-volt peak-to-peak audio signal with an impedance of 47 ohms ² ; right channel

¹ This stereo, miniature phono plug is present on the Macintosh SE/30, II, IIx, IIcx, IIfx, IIci, and Portable. The internal speaker is disabled when this connector is being used.

² The Macintosh Portable produces a 0.75-volt peak-to-peak signal.



Ports and Cables

External Connectors—Pin-Outs



CAUTION: The SCSI interface uses the same type of connector as a standard RS-232 serial interface, but is electrically very different. **DO NOT** connect any RS-232 device or cable to this connector. Doing so can result in damage to both the device and the computer.

SCSI Connector¹

Pin	Signal	Signal Description
1	REQ/	Request
2	MSG/	Message
3	I/O	Input/output
4	RST/	Reset
5	ACK/	Acknowledge
6	BUSY/	Busy
7	GND	Signal ground
8	Data0/	Data bit 0
9	GND	Signal ground
10	Data3/	Data bit 3
11	Data5/	Data bit 5
12	Data6/	Data bit 6
13	Data7/	Data bit 7
14	GND	Signal ground
15	C/D	Control/data
16	GND	Signal ground
17	ATN/	Attention
18	GND	Signal ground
19	SEL/	Select
20	PARITY/	Data parity
21	Data1/	Data bit 1
22	Data2/	Data bit 2
23	Data4/	Data bit 4
24	GND	Signal ground
25	TERMPRW	+5 volts (terminator power) ²

¹ This male DB-25 connector is on all Macintosh computers except the Macintosh 128K, 512K, and 512K enhanced.

² Terminator power is not provided on the Macintosh Plus.

Ports and Cables

External Connectors—Pin-Outs



External Video Connector—Ilci *

Pin	Signal	Signal Description
1	RED.GND	Red video ground
2	RED.VID	Red video
3	CSYNC/	Composite sync
4	MON.ID1	Monitor ID, bit 1
5	GRN.VID	Green video
6	GRN.GND	Green video ground
7	MON.ID2	Monitor ID, bit 2
8	NC	No connection
9	BLU.VID	Blue video
10	MON.ID3	Monitor ID, bit 3
11	C&VSYNC GND	Composite & vertical sync ground
12	VSYNC/	Vertical sync
13	BLU.GND	Blue video ground
14	HSYNC.GND	Horizontal sync ground
15	HSYNC/	Horizontal sync
Shell	CHASSIS GND	Chassis ground

* The external video connector on the Macintosh Ilci is a male DB-15 connector.



Ports and Cables

External Connectors—Pin-Outs

External Video Connector—Portable *

Pin	Signal	Signal Description
1	FPDATA(0)	Flat panel display data bus (bit 0)
2	FPDATA(1)	Flat panel display data bus (bit 1)
3	+5V	+5 volts DC
4	FPDATA(2)	Flat panel display data bus (bit 2)
5	FPDATA(3)	Flat panel display data bus (bit 3)
6	FPDATA(4)	Flat panel display data bus (bit 4)
7	GND	Ground
8	+5V	+5 volts DC
9	GND	Ground
10	FPDATA(5)	Flat panel display data bus (bit 5)
11	FPDATA(6)	Flat panel display data bus (bit 6)
12	FPDATA(7)	Flat panel display data bus (bit 7)
13	BATT_VOLTAGE	Direct connect to main battery
14	FLM	Flat panel new frame sync
15	CL2/	Flat panel display data clock

* The external video connector for the Macintosh Portable is a male DB-15 connector.

Ports and Cables

Notes

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There are approximately 20 lines visible. The paper has a slightly aged or off-white appearance. There is no handwriting or other markings on the page.



Ports and Cables

Notes

Phone/Address Directory

[illegible]

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